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EDITORIAL.

Insect Pests.

Agriculturists are prone to consider that insect pests are more numerous or troublesome in their particular country than elsewhere. This is perhaps a natural reaction to a problem which everywhere constitutes a menace to agriculture. The authors of our principal article in this number remark on the small number of enquiries they receive from the public concerning insect pests. They suggest as an explanation that the literature on this subject is comprehensive so that planters refer to the written word rather than directing an enquiry to the Department. This is undoubtedly a contributory explanation, but we suggest that another reason is that rubber, the main crop of the country, is remarkably free from insect pests while the major pests of coconuts are now well defined and the methods of treatment well known to managers.

There remains, however, a large number of crops, grown in comparatively small areas and usually by Asiatics, which are subject to insect attacks that are less well understood by the cultivator and some of which possibly have not been observed by the entomologists. Many of these Asiatic cultivators do not speak English or do not know that they may submit their difficulties to the investigators at headquarters. We suggest, however, that many such cultivators know of the presence in their neighbourhood of officers of the Field Branch of the Department, and it is to them that they naturally turn for advice. We would mention also that from time to time articles on the treatment of pests are published in Malay, Chinese and Tamil, by the Department, and these regular publications have a wide circulation amongst Asiatics. From one source or another, therefore, planters in this country are usually able to obtain the advice they require without reference to the Entomological Division of the Department.

While, therefore, direct advisory work constitutes but a small part of the activities of the entomologists, these officers are nevertheless fully occupied in research work, and the widening of the scope of agriculture which has taken place during the past few years has added to their responsibilities by reason of the commercial production of a number of crops which were almost unrecognized in Malayan agriculture a few years ago. Each such crop brings its own insect problems and it must be remembered that the presence of an appreciable area under a crop frequently results in an increase of attack by an insect which previously occasioned but little damage owing to the scarcity and scattered distribution of its host plant.

In connexion with plant diseases we have already published Notes on similar lines to the entomological notes which are included in the present number. Writing editorially on the Notes on plant diseases we stated:— "Certain of these investigations are of wider interest than is indicated by the isolated enquiry and yet do not warrant publication of special reports. It is true that much of this information may be found in a very condensed form in annual reports, but many of those interested do not see annual reports, or if they do, would desire fuller information than can be included in that place."

What we wrote concerning plant diseases applies with equal force to entomological investigations, and for these reasons, therefore, we are assured that the article which provides the main feature of this issue will be read and, we hope, kept for future reference by planters in Malaya.

At a time such as the present, it is natural that pride of place is given to the insect pests that attack foodstuffs. The storage in bulk of large quantities of food to ensure supplies to replace those which may be interrupted by the vagaries of shipping or by other war conditions has brought into prominence the problem of insects associated with storage. This problem is not the concern only of those in control of the large stores in various parts of the country, but concerns also all employers of labour who on a smaller scale are confronted with similar conditions, and also, it may be added, the small producer who desires to retain his crop for future consumption.

But whether we consider the growing crop or the stored product, insect pests may cause very substantial loss and damage. It is therefore particularly important at the present juncture to circumvent losses and damage from whatever cause, and as a guide to solution of many of the problems arising in this connexion, we commend to the attention of the public this review of the entomological investigations carried out in recent years by the Department of Agriculture.

Original Article.

A REVIEW OF SOME RECENT ENTOMOLOGICAL INVESTIGATIONS AND OBSERVATIONS.

By
G. H. Corbett,
Senior Entomologist,
and
H. T. Pagden,
Entomologist.

In this review, the writers have indicated the results from some entomological investigations which have been or are in progress and have recorded certain important and interesting observations arising from enquiries of an entomological character during the past few years. In a resumé of this character, it is not possible to deal with all the entomological problems which have come to our notice, but, in preparing this digest, we have been struck with the comparatively few enquiries concerning the control of insect pests which have been received from the Malayan public. We are inclined to the opinion that this is because it is not generally appreciated that advice as to the control of insects is always given willingly and freely by Officers of the Entomological Division of this Department.

The Importation of Parasitic and Predaceous Insects.

Requests from overseas for a supply of certain parasites have occasionally been received, and it has been possible in some instances to accede to them, but in this connexion the most important assistance rendered by this Department concerned the introductions into Jamaica and Australia of *Dactylosternum hydrophiloides* (Macl.), the grubs of which are predaceous on the grubs of the banana weevil borer, *Cosmopolites sordidus* Germ. This investigation was commenced as far back as August, 1934, when Sir Guy A. K. Marshall, Director, Imperial Institute of Entomology, sought information as to the presence of parasites and predators of *Cosmopolites sordidus* Germ. in Malaya with a view to their importation into Jamaica. The details concerning these introductions are given in Table I.

Reports from Jamaica in 1939 showed that eggs, larvae and adults had been recovered in the field, that the beetles had scattered over wide areas, and that the establishment of the predators was progressing so satisfactorily that no further introductions were necessary.

Reports from Australia were received to the effect that *Dactylosternum* had become established, that the beetles had survived a rather severe winter and that there were indications that the insect was spreading naturally and beginning to exercise a definite control on the banana beetle borer.

Table I.

Date consignment despatched	*Dactylosternum* in consignment	Route	Result
September 1st, 1937 ...	1700	By ship to Sydney to New Zealand and Jamaica	All beetles arrived dead.
December 30th, 1937 ...	3300	By air to Sydney, ship to New Zealand and Jamaica.	284 live beetles arrived in Jamaica.
September 23rd, 1938 ...	6000	By ship to Hong Kong, Vancouver and Seattle. By rail to San Francisco and by ship to Jamaica.	96 live beetles arrived Jamaica.
June 16th, 1939 ...	6000	By air to Southampton thence by ship to Jamaica.	619 beetles arrived alive.
August 25th, 1939 ...	7500	By air to Southampton and thence by ship to Jamaica.	Beetles in this consignment all died. It arrived at Southampton on September 3rd, 1939.
December 15th, 1938 ...	6780	By air to Brisbane for Australia.	Arrived in excellent condition.
October 27th, 1939 ...	7000	By air to Brisbane.	Arrived in excellent condition.

The introduction of the Giant Toad (*Bufo marinus*) into Malaya has on several occasions received careful attention but we are of the opinion that its importation would be unwise. This toad has been responsible for controlling effectively "white grubs" in some countries and may do so if introduced into Malaya, but it should be remembered that *Bufo marinus* has been more successful in those countries where there is no indigenous toad fauna and that it has been reported preying upon *Bufo melanostictus* in Formosa. *Bufo melanostictus* is established at Cameron Highlands and is the most prevalent and widely distributed toad in the Lowlands of Malaya. We have even considered the possibility of limiting the importation of *B. marinus* to Cameron Highlands, but are of the opinion that there would be grave risk of its conveyance from there to the Lowlands, and in addition our information suggests that the propagation of *Bufo marinus* is restricted at high elevations.

Arrangements were well advanced in September 1939 for a trial shipment of the Amazon Fly, *Metagonistylum minense* Towns., from British Guiana for the purpose of ascertaining whether this parasite would prove an effective check to *Diatraea polychrysa* Meyr., a stem borer of padi in Malaya, but this project has had to be postponed indefinitely.

Cameron Highlands, which is reached by a road running through about 20 miles of jungle, has comparatively recently been opened up. It is situated at about 5000 feet and may possibly be considered as an ecological island. The first importation to Cameron Highlands was made in November, 1935 when the Scoliid parasite, *Campsomeris prismatica* (Sm.), an effective parasite of *Melolontha hastata* Arr., whose grubs are prevalent on the golf course, Fraser's Hill, was transferred to the golf course, Cameron Highlands, with a view to controlling *Anomala shanica* Arr. This beetle was under investigation during the time of Mr. J. W. Jepson's visit to Malaya and, in view of his intention to collect certain species of Scoliids in Java for introducing into Mauritius, he was approached as to the possibility of sending to this Department a collection of parasites for liberation at Cameron Highlands. As a result of this approach, we received a consignment consisting of *Campsomeris quadrifasciata* (F.) var. *fimbriata* (Burm.), *C. leefmansi* Betr. and *C. annulata* (F.). These Scoliids were liberated in February 1936 at different places around the golf course, Cameron Highlands, but up to the time of writing no representative of any of these species has been recovered and it would appear therefore that all species have failed to become established. Certain lowland species of Reduviids have also been transferred to Cameron Highlands in the hope that they may control *Helopeltis* on tea, (v. under Tea).

In view of the general belief among residents as well as visitors that this Department was responsible for the importation of the wasp, *Vespa auraria* Sm. to Cameron Highlands, it may be of interest to record that *Vespa auraria* was collected at Cameron Highlands in 1930, *i.e.* 5 years before *C. prismatica* from Fraser's Hill was introduced or 6 years before the Java material was imported.

Padi in the Field.

Since October 1932 padi has been sown in irrigated tanks on the first day of each month. This investigation was primarily concerned with the question of vital rhythm in stem borers*. Earlier observations ([1], [2], [3]) had suggested that there was a peak period for reproduction which was not entirely dependent on the abundance or otherwise of the food plant. The investigation at Serdang was designed to test this and to ascertain whether better crops of padi could be obtained by sowing slightly earlier than is normal.

Throughout the whole of this investigation it has been found that padi sown in May and June gave a more consistent yield than that sown at any other time; the yield was not always the highest for the year but, averaged over seven years, these two months gave a better yield than any other over the same period.

During this work a record has been kept of all borer egg-masses found on the leaves of the plants, thus providing an indication of the reproductive activity of the borers. It has been found that the smallest number of egg-masses occurs from the beginning of June to the end of September, followed by a sharp increase from Octo-

* The stems borers concerned are *Diatraea polychrysa* Meyr. *Chilo suppressalis* (Walk.), *Schoenobius incertellus* (Walk.), and *Sesamia inferens* (Walk.).

ber to January, a drop in February (usually a dry month), another rise in March and then a sharp drop. The fluctuations in egg-masses and yields are illustrated in the accompanying graph.

It should be pointed out here that the scene of this work at Serdang is isolated from regular padi areas and that the prevailing wind blows from the experimental area towards the nearest padi areas during what were found to be good months and from the neighbouring padi areas towards the experimental area during the bad months. It might, therefore, be argued that the variations in yield were due to moths being blown into or away from the experimental area. That this is not so is shown by comparison with yields obtained in the main padi areas of Perak, Selangor, Negri Sembilan and Malacca were late sowings invariably produce poor results, while early sowings, May to July, give good yields.

While numerous factors undoubtedly play their part in determining the crop from any particular sowing, the depredations of borers are believed to be not unimportant. In an endeavour to find out to what extent borers influence yield, padi was sown in wire cages and moths were introduced into one cage and not into the other. The first trial was started in January 1933, normally a poor time for sowing, and the second in May 1934, normally a good month for sowing. Neither of these gave any definite results. The mesh of the wire was then reduced slightly by giving two thick coats of enamel and a further trial carried out with a November 1935 sowing. This trial differed from the first two in that no moths were introduced, though larvae, probably wind-borne, obtained access, and the number of bored tillers and the yield were compared with padi grown outside. The results appeared to justify a further trial for the protected padi gave an equivalent yield of over 200 gantangs per acre against an equivalent yield of 70 gantangs per acre for that grown outside. A final trial in this series was made in August 1936 and again results were markedly in favour of the protected plants. It was observed in all the above trials that the padi within the cages tillered much less freely than the exposed plants. The following table shows the results of the November 1935 and August 1936 sowings:—

Table II.

Description	Total tillers	Total bored tillers	Percentage bored	Tillers killed by borers	Percentage of total	Crop calculated as gantangs per acre
November 1935						
Cage 17 ...	212	114	53.7	34	16	202
Cage 34 ...	214	69	32.3	37	17.6	215
Exposed ...	641	428	67	354	55.2	70
August 1936						
Cage 17 ...	254	104	40.9	48	18.9	375
Cage 34 ...	266	82	30.8	15	5.6	480
Exposed ...	705	433	61.4	331	47	250

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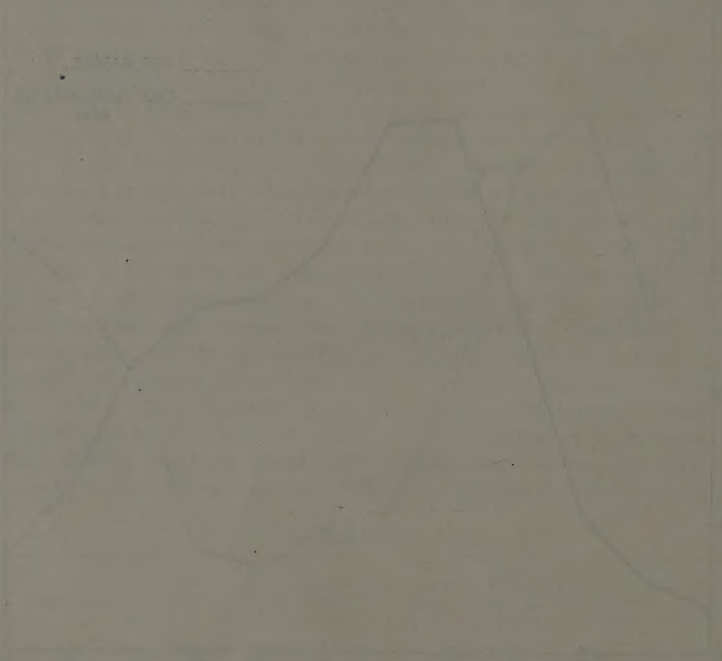

Subsequently further trials under muslin curtains, using a greater number of cages, were carried out. In the first of these there were two control cages and five treatments. Three cages had the curtains raised at night for one, two and three months of growth in order to allow natural infestation to develop during each of these periods, two cages received 20 egg-masses of borers, 5 at a time at weekly intervals starting when the plants were 46 days old, and one cage received a total of 125 egg-masses spread over the same period. All tanks were closed during the day to avoid differences in light intensity. Seed was sown on the 24th. March and planting out was done on 3rd. May, 1938. The padi variety Radin Siak 17 was used. The results were as tabulated below:—

Table III.

	Control I	Control II	Exposed 1 month	Exposed 2 months	Exposed 3 months	20 Egg-masses	125 Egg-masses
Yield (grammes) ...	514.9	467.1	472.1	130.2	116.4	42	nil
Total tillers ...	403	403	389	379	329	399	146
Bored tillers ...	0.75	0.25	31.6	97	98	99.9	96

These figures clearly bring out the effect of borers on yield and suggest that attack during the first month after planting out has little effect.

In the second of these trials, seed was sown on 12th. October, 1938. Two controls were used as before, all tanks were closed throughout the experiment and 10 egg-masses of borers were introduced into two cages each at 90, 105, 120, 135 and 165 days after planting out. The results, while showing, on the average for each pair of tanks, a somewhat similar effect, were much more uneven. These are shown in the following table.

Table IV.

	Control	Eggs in at: 90 days	105 days	120 days	135 days	150 days	165 days
Average yield (grammes) ...	302.6	134.6	26.3	237.2	259.9	187.8	567.5
Average tillers ...	143	228	216	208	180	150	170
Per cent. bored at harvest ...		99.5	100	97.5	81.5	96	27

In the third experiment there were four controls and two treatments, each of which was replicated five times. The padi was sown on the 1st June, normally a good time for sowing, and five cages were infested with 20 egg-masses each when the plants were 60 days old, a similar infestation being given to the other five cages when the plants were 120 days old. Instead of allowing the infestation to build up as with the other experiments, the borers were allowed one month to do their damage and thereafter daily heavy sprayings with derris extract and hand collection of any adult moths which emerged and of egg-masses on the leaves, was carried out. A definite time of attack was thus established. In addition to the cages two unprotected plots were planted for comparison of natural damage and natural yield. Table V shows the results.

Table V.

	Control	Eggs in at 60 days	at 120 days	Exposed plots
Average yield (grammes)	485	356	240	483
Average no. tillers per tank ...	172	306	332	507
Per cent. tillers bored at harvest	4.0	53	41	82

The shading effect of the cages on the total number of tillers produced is well brought out. The similarity in yield between the control cages and the exposed plots is remarkable when the number of tillers and percentage of bored tillers at harvest are compared.

Throughout the whole of this work an individual tiller count was kept with regard to time of appearance, date of attack by borers, death of tiller and cause where known, and yield from each tiller. The analysis of the results of nearly eight years' work will require a great deal of time and, at the time of writing, no definite conclusions can be drawn. It can be stated, however, that for padi Radin 2 at least, good yields may be expected from May and June sowings; April, July, August and September sowings may be expected to give very uneven results, yields sometime being high; while January to March and October to December as sowing months may be expected to result in poor to very poor crops, or even no yield at all.

Preliminary statistical analysis has indicated that:

(1) There is a high positive correlation between yield and surviving tillers produced in the first three months.

(2) There is, for individual tanks, a high positive correlation between numbers of egg-masses found in the first 16 weeks and numbers of 1 to 3 month tillers killed by borers.

(3) There is, for individual tanks, a fairly high negative correlation between yield and egg-masses found in the first 16 weeks.
(4) There is no correlation between yield and surviving tillers produced in the fourth and subsequent months.

Another problem which has been under investigation is that of empty glumes of otherwise apparently healthy padi. This trouble appeared to be progressive over quite an extensive area at Kuala Linggi, Malacca. Examination of padi in the field failed to reveal any definite cause of the trouble. Subsequently most of this area went out of cultivation but one field was kept under cultivation in the hope of ascertaining the cause of the trouble. The first insect found as really numerous was *Haplothrips ganglbaueri* Schmutz, which was swarming on the inflorescences, both nymphs and adults being found. This thrips occurs elsewhere in Malacca, but had never before been seen in such numbers. Embryos within the glumes had previously been observed to be much distorted and this rather supported the view that the thrips might be responsible for the failure of the embryo to develop. Next season *Sogata furcifera* (Horváth) was found to be very numerous on the plants in this plot and it was observed that they were feeding at the top of the stems, just below the inflorescences, an unusual situation. Inflorescences were bagged and yields were obtained, while no yield was obtained from the unbagged heads.

In the following season an experiment was laid down to repeat this observation under controlled conditions and, at the same time, four concrete tanks, which could be irrigated by a pump, were constructed at the Padi Experiment Station at Pulau Gadong. Two of these tanks were filled with soil from the affected area, the other two with Pulau Gadong soil, and all four tanks were screened with strong muslin to exclude insects. It was proposed, when *Sogata* appeared on the plants at Kuala Linggi to transfer specimens to two of the tanks at Pulau Gadong, one containing Pulau Gadong soil and one containing Kuala Linggi soil. For two years in succession this intention has failed owing to severe drought conditions, and the consequent entire failure of the Kuala Linggi area when still quite young, but another interesting fact, which may have some bearing on the problem, emerged, namely that padi on the Kuala Linggi soil in the tanks made very much less vigorous growth than did the padi growing in Pulau Gadong soil and the crop from it was very much less. Yields for two years are shown in Table VI.

The variety of padi used throughout has been Nachin 66, which was that normally cultivated in the Kuala Linggi area, and a single nursery was used to supply all seedlings.

Padi, Rice and Cereal products in Store.

There are two problems involved in the storage of grain: how to prevent damage by insects and how to treat infested grain. It is obviously best to prevent attack rather than to wait until after it has developed.

Table VI.

Season	Cage No.	Soil	Water Supply	Tillers per plant	Yield
1939 to 1940	1	Pulau Gadong	Pulau Gadong	18	1477 grammes
	2	" "	" "	20	2045 "
	3	Kuala Linggi	" "	12	454 "
	4	" "	" "	13	682 "
1940 to 1941	1	Pulau Gadong	Pulau Gadong	17	1591 grammes
	2	" "	" "	15	1136 "
	3	Kuala Linggi	" "	11	227 "
	4	" "	" "	8	227 "

Dusts.

Recent research in numerous countries has tended towards the employment of so called "inert dusts" which, when mixed with grain, prevent insect attack or even destroy insects already present in the grain. Such dusts must be cheap, innocuous to humans and only small quantities should be required to effect control.

The following dusts have been examined in this Department; 1937, a proprietary dust Divisional reference "A", recommended for protecting wheat against weevil attack; 1939, calcium carbonate in the form known as precipitated chalk, flowers of sulphur; 1940, proprietary dust Divisional reference "B". In addition other dusts are being tested.

Tests of this nature of necessity take time and must be conducted with care. While preliminary tests *in vitro* may give an indication of what to expect they cannot be considered as final. They may serve to eliminate certain dusts at once, but dusts which show up well in such tests must then be tried under conditions as close to normal storage as can be obtained in the laboratory and such tests must be run long enough to make certain that any lethal effect does not pass off under storage conditions.

So far "A", "B", and precipitated chalk have given very promising results but "A" discolours the grain and is unlikely to be acceptable for this reason.

Fumigants.

As regards the fumigation of already infested grain the commonest fumigant, and one of the most lethal to all animal life, hydrocyanic acid, has not proved a success in stores containing sacks of rice, owing to lack of penetration, high degree of absorption by the grain and high residual cyanide in the treated grain. Chloropicrin, on the other hand, has proved highly efficient for treating small stores of up to 100 sacks provided that the store can be rendered airtight and the liquid is applied to the sacks themselves. It will not penetrate large masses of tightly packed grain.

The question of penetration of a fumigant is important for sometimes, even if a store cannot be rendered airtight, it is possible to fumigate under tarpaulins, provided that penetration is reasonably rapid. Chloropicrin is generally considered to be a good penetrating fumigant but experiment has shown that it will not penetrate tightly packed grain to a greater depth than 5 feet even when used at 10 times the maximum commercial dosage and with four days exposure in a sealed container. The addition of an equal volume of carbon tetarchloride, to increase volatility, was not found to improve penetration.

Apart from any other considerations local storage practice renders fumigation practically impossible.

Another gas which has been investigated is carbon dioxide. This gas is liberated from respiring seeds, though extremely slowly and it has been used on a commercial scale for dealing with insects infesting stored wheat. It was felt that more information should be obtained regarding the action of this readily available gas. An experiment was therefore set up to determine the time of exposure necessary to kill all stages of all insects in badly infested rice, the gas being used at well above its lethal concentration for any active stage of the insects. It was found that, even in an atmosphere of nearly pure carbon dioxide, adult weevils showed 10 per cent. recovery after 24 hours in the gas and that partial recovery, followed by death after about a day, occurred after 48 and 72 hours exposure. Three weeks exposure in an atmosphere of nearly pure carbon dioxide was required to destroy all stages of all insects.

Quite low concentrations of carbon dioxide will inhibit insect activity and it may be possible, when further investigations are completed, to utilize this fact in the successful storage of padi as opposed to rice.

Temperature.

Much work has been carried out elsewhere on thermal death points and it is not the purpose of this brief resumé of work carried out locally to enter into a detailed discussion of this problem. It is generally agreed that a temperature between 49°C. and 51.6°C. will, if maintained for 12 hours, destroy all stages of all insects attacking grain and cereal products.

To raise a large bulk of grain to such a temperature, and to maintain that temperature for 12 hours is likely to prove exceedingly difficult.

Small scale experiments with infested grain subjected to temperatures of 50°, 55° and 60°C. for periods ranging from 15 minutes to 2 hours have been carried out. The insects involved were *Calandra oryzae* (L.), *Tribolium castaneum* (Herbst.), *Oryzaephilus surinamensis* (L.) and *Laemophloeus* sp. (? *pusillus* (Schön.)).

In brief ¾ hour at 60°C. killed all insects; 2 hours at 50°C. killed all adult insects except *Laemophloeus*, which was unaffected. *Calandra* stood a temperature of 60°C. for 30 minutes.

In these tests the quantity of grain used was small so that the heat penetrated all parts of the container. Heat treatment for large quantities of grain would require special apparatus of the type used for the artificial drying of grain.

Humidity and Moisture.

The relative humidity of the atmosphere and the moisture content of the grain are important factors in successful, insect-free storage. Experiment has shown that, at the normal temperatures prevailing in Malaya, a relative humidity of 60 per cent. or less greatly slows up the breeding of the rice weevil, *Calandra oryzae*; reduction of the relative humidity of the atmosphere to as low as 50 per cent. has little greater effect: lower figures have not been investigated. At a relative humidity of 70 per cent. or over *Calandra* breeds rapidly, there may be a forty-fold increase from each female in two months at 70 per cent. relative humidity and this may be greater at higher humidities. The lesser grain borer, on the other hand, thrives better in dry atmospheres.

Insects in Stored Products.

A large number of insects may be found in padi and rice stores but only some of these are serious pests. Among the beetles the commonest are the following:—

Calandra oryzae (L.)
Rhizopertha dominica (F.)
Lophocateres pusillus (Klug.)
Laemophloeus pusillus (Schön.)
Oryzaephilus surinamensis (L.)
Ahasverus advena (Waltl.)
Tribolium castaneum (Herbst.).

Reports are sometimes received of "weevils" being very numerous in rice and investigation has shown the insect to be some quite other species, not primarily responsible for damage to the grain, probably present on account of bad storage conditions and feeding on débris, microscopic fungi or the residue of some other substance previously stored in the sacks.

All the insects enumerated above, with the exception of *Ahasverus*, which has been shown to be mycetophagus ([1]), have been examined for their ability to damage grain in different states and conditions of storage. These experiments were of necessity on a small scale as will appear from the details given. Sound padi and sound Rangoon rice were selected, grain by grain, for the experiments. The following materials were used as media for the insects under examination: sound padi, broken padi, husk, sound padi with the husk punctured by a needle, sound hand-hulled grain, sound rice, broken rice, bran. Most of these were tested at the normal temperatures and humidity of the laboratory and in an atmosphere kept damp by means of a pad of cotton wool in a dish of water. In some of the damp atmosphere tests the material became very mouldy, which may have accounted for certain insects failing to maintain themselves. The results of these tests are tabulated below and

it will be observed that perfectly sound padi was not damaged by any of the insects under observation, but once the husk was injured mechanically by puncture with a needle, *Calandra*, *Rhizopertha* and *Lophocateres* all fed and bred in it. *Laemophloeus* caused no visible damage to any grain, nor did it breed therein, but life was maintained for a long time on damp rice and on broken rice. *Tribolium* and *Oryzaephilus* fed on the germ of hand-hulled rice, but caused no measurable damage to sound rice.

Table VII.

Medium	*Calandra* Fed.	*Calandra* Bred.	*Rhizopertha* Fed.	*Rhizopertha* Bred.	*Lophocateres* Fed.	*Lophocateres* Bred.	*Laemophloeus* Fed.	*Laemophloeus* Bred.	*Tribolium* Fed.	*Tribolium* Bred.	*Oryzaephilus* Fed.	*Oryzaephilus* Bred.
Sound padi	—	—	—	—	—	—	—	—	—	—	—	—
" " damp	—	—	—	—	—	—	—	—	—	—	—	—
Broken padi	+	+	not tested		+	+	not tested		+	+	—	—
" " damp	+	+	"	"	+	+	"	"	†	—	+	+
Husk	—	—	"	"	—	—	—	—	†	—	—	—
" damp	—	—	"	"	—	—	—	—	†	—	not tested	
Sound padi, pricked	+	+	+	+	+	+	not tested		—	—	"	"
" " " damp	+	—	+	+	+	+	"	"	†	+	"	"
Hand hulled rice	+	+	+	—	+	—	"	"	+*	+	+*	+
" " " damp	not tested		not tested		not tested		"	"	+	—	+	+
Sound milled rice	+	+	+	+	+	+	—	—	†	—	—	—
" " " damp	+	—	—	—	†	—	—	—	†	—	not tested	
Broken rice	+	+	not tested		†	—	—	—	†	+	†	+
" " damp	—	—	"	"	+	+	—	—	†	+	†	+
Bran	not tested		"	"	not tested		—	—	†	+	†	—
" damp	"	"	"	"	"	"	—	—	†	+	†	—

— Negative results.
\+ Positive result.
* Adults fed on germ only.
† indicates that adults lived for a long time but there was no visible sign of damage.

Female rice weevils bred and mated in the laboratory have lived for more than 245 days, though 120 days would seem to be a fair average. Under normal conditions of temperature and humidity for Kuala Lumpur one female produced 125 offspring during a life of 109 days. The average number of eggs produced by weevils under observation has been 61 per female, but some of these lived only a short time and produced very few or no eggs.

From time to time enquiries are received about insects in flour and in packaged foods. Flour is extremely difficult to keep under local conditions and if storage for any length of time is contemplated it is essential that special storage be provided. The same applies to cartoned cereal foods.

An enquiry regarding *Calandra oryzae* attacking macaroni and *Tribolium castaneum* in flour and packaged cereals was received in 1937. It was recommended that these commodities should be stored in air conditioned rooms if practicable and

a relative humidity of 60 per cent. was suggested as likely to prevent serious trouble. This suggestion was adopted and, two years later, it was learned that no further trouble had been experienced.

We have no evidence of the moisture content assumed by various prepared foods under such conditions of storage, but experiments have shown that rice may be expected to reach a stable moisture content of about 9.5 per cent. and padi about 10.0 per cent. when stored in an atmosphere kept constant at about 60 per cent. relative humidity with air circulation. This relative humidity was attained by keeping the rice over sulphuric acid of specific gravity 1.30 and passing the circulating air through towers of acid of the same specific gravity.

General Remarks.

We cannot stress too strongly the importance of cleanliness in grain stores. They should be thoroughly cleaned out at least once a year. In addition we cannot over emphasize the fact that severe infestation of grain is a sure sign of bad storage conditions and once grain in bulk becomes severely infested with insects it requires special arrangements, not available in Malaya, to fumigate it. Suitable fumigants are not available in bulk in Malaya and even if they were available, local methods of storage would render their application not only difficult but most ineffective.

Coconuts.

Since the publication of "Insects of Coconuts in Malaya," ([5]) there has been a decrease in the number of enquiries concerning the habits and control of insects damaging the coconut palm, but whether this is due to that information being in an accessible form or whether to a feeling that the expenditure involved in controlling insects of coconuts may be greater than the loss in revenue incurred by them is uncertain. In the past, it was assumed that insects boring the female flowers or inflicting minor damage to the leaves of palms were responsible for some loss in nuts, but this assumption was not based on a detailed study of insects in their relationship to the yield of coconuts. We have, however, investigated in considerable detail the economic importance of the greater coconut spike moth (*Tirathaba rufivena* (Walk.)) whose caterpillars bore the female and male flowers of the coconut palm, and, while a simple and effective measure for its control was discovered, this insect was not found to be involved in a reduction in the yield of coconuts. The results of that work ([6]) are herewith summarized.

1. The removal of the sheath of the inflorescence of the coconut palm, just before the spikes would normally have burst, has been demonstrated to be a satisfactory control measure.

2. *Tirathaba rufivena* (Walk.) has been shown to bore an average of 9.4 per cent. of female flowers. This is not a high percentage and even if it could be entirely prevented thus increasing the number of flowers (nuts) remaining, the cost of control measures would possibly not be economically justified.

3. The results indicate that on a reduction of *Tirathaba* bored female flowers, the fall from other causes increases and suggest that this insect would have to bore 58 per cent. of female flowers before occasioning any reduction in the yield of nuts.

4. It has been ascertained that the maximum number of female flowers is bored at about the second week, that the maximum number of female flowers falls at about the fifth week and less than 42 per cent. of female flowers produce nuts.

These conclusions were based on weekly records of nearly 10,000 female flowers of the coconut palm.

An enquiry into the importance of the Black or Rhinoceros beetle is, we consider, unnecessary for as a result of continuous attacks by this beetle nutless, dying and dead palms may frequently be observed.

We have, however, endeavoured to ascertain the effect of complete defoliation on yields from palms by removing all the leaves, even to the last leaflet. Our results show that all palms recovered after the treatment, but whereas nuts were harvested in decreasing numbers for 6 months after defoliation of the palms, no nuts were produced in the following 19 months. After that period a gradual increase occurred with a maximum production in about the 41st. month after defoliation, *i.e.* complete recovery in $3\frac{1}{2}$ years after total defoliation. Under natural conditions, however, palms never suffer complete defoliation by caterpillars. Whilst this investigation was in progress an opportunity was afforded in 1932 of ascertaining what reduction in yield of coconuts was occasioned by an extensive defoliation of palms by *Artona*. The outbreak terminated towards the end of that year. Monthly and annual yields were obtained not only from the defoliated but from a non-defoliated area in the same neighbourhood. In 1937, when these records were being examined, the defoliated area was again visited by *Artona*, this outbreak subsiding about the end of that year. The coconut palms in the control area were cut out during 1938, but yields of coconuts for 1932 to 1940 from another area in the same neighbourhood were obtained. While the yields of coconuts from both control areas show similar annual fluctuations throughout, those from the defoliated area are markedly dissimilar. The observations will be published in the near future, but it may be said that while there is a considerable decrease in the yield of coconuts in the year following the defoliation of palms, this is succeeded in the following years by a considerable increase in the yield of nuts which may off-set the decrease. This statement relates to outbreaks of insects of comparatively short duration. It is obviously not applicable to palms which are subject to continuous defoliation by insects through a period of several years.

Parasites play an important rôle in terminating outbreaks of certain insects associated with the coconut palm. For instance, the caterpillar of *Parasa lepida* (Cram.) is frequently seen encircled with large numbers of cocoons of the Braconid, *Apanteles parasae* Rohw., and its pupa within the cocoon is often parasitized by the Chrysid, *Chrysis* (*Pentachrysis*) *shanghaiensis* Smith. In the case of *Chalcoscelis albiguttata* Snell., the young caterpillar suffers a considerable mortality from a bacterial wilt and is heavily parasitized by the Braconid, *Fornicia chalcoscelidis*

Wilkn., whilst its pupa within the cocoon is killed by an entomogenous fungus, a species of *Cordyceps*. The caterpillar of *Hidari irava* Moore succumbs not only to parasites but also to a bacterial wilt and while the stages of *Artona catoxantha* (Hamps.) are parasitized, the parasites are not, we consider, the factor responsible for terminating outbreaks of this moth. They are subdued almost, if not always, by climatic agents, high winds and heavy showers. Between outbreaks, parasites may be effective in preventing for a period an outbreak of this moth.

Caterpillars of moths, such as *Artona*, *Chalcoscelis*, *Parasa* and *Mahasena*, are found in varying numbers of coconuts, but their presence, unless in considerable numbers, cannot be placed to the discredit of those supervising the property. On the other hand, when palms are damaged by the black beetle (*Oryctes rhinoceros* (L.) it is generally a sure indication that the supervisor of that property has neglected to deal efficiently with the breeding places of the beetle. There are, of course, exceptions to this statement, as for instance where a coconut property adjoins a neighbour's replanted area of rubber in which steps have not been taken for the disposal of old boles and stumps. Several instances of the rhinoceros beetle breeding in old rubber boles and stumps have come to our notice and, where necessary, steps have had to be taken to enforce the regulations devised to meet such situations. Another instance concerns the breeding of *Oryctes* at saw-mills adjoining coconut properties. The disposal of accumulations of saw-dust, especially where a mill is situated on peat, presents considerable difficulties, and we consider that permission to erect saw-mills in such situations should not be granted. In recent years an increase in this beetle's activities has been observed, more damaged palms than formerly are to be seen in various parts of Malaya, indicating that attention to the breeding places of this beetle, not only on native holdings but also on estates, has not been as close as formerly. In connexion with the control of *Oryctes*, it is important that its grubs should be recognised otherwise payments for the collection of those of harmless species may be made. Closely associated with the recognition of the grubs of *Oryctes* is the identification of the more common caterpillars of the coconut palm, otherwise a useless expenditure may be incurred by applying ineffective measures. For instance, encircling the coconut palm with sticky bands to prevent the caterpillars of *Artona* and *Mahasena* re-ascending the palms after they have dropped to the ground by means of silken threads is recommended but the application of this measure for the control of *Hidari* would not be successful, since its caterpillars are not in the habit of descending to the ground. Of interest is the collection of large numbers of egg-masses of the Noctuid moth, *Spodoptera pecten* Guen., from the leaves of the coconut palm. In the laboratory, its caterpillars could not be induced to feed upon coconut leaves. This moth is known to deposit its eggs promiscuously, using any plant or object. In this case, its host was a grass cover on which its caterpillars had fed.

Copra.

With more attention to the production of good copra the insects associated with poor quality copra have not been so prevalent. Our investigation (4) showed that damage to copra by insects could be almost entirely eliminated by the following measures:—

the preparation of good quality copra;
the freeing of sacks from insects;
the maintenance in a clean condition of stores on estates and at ports;
the storage of rice away from the copra store; and
the prevention of the accumulation of copra stocks on estates and at ports.

Oil Palms.

A disease of oil palms in which the leaves bend sharply over and form a kind of tent round the palm has been stated to be due to an eelworm infestation. Eelworms have sometimes been present in the decayed portions of leaves but our observations indicated that they were of a secondary nature since leaves with similar symptoms but without eelworms were numerous. Eelworms, however, were forwarded to the Imperial Institute of Entomology for examination by Dr. T. Goodey who stated that four species were present, all belonging to the typically free living saprophagous genera, *Rhabditis* and *Diplogaster*. One species, *Diplogaster striatus*, has previously been recorded from diseased coconut tissue in Trinidad.

Oil palm trunks are difficult to dispose of and no satisfactory method, other than burial, for their disposal has been found. We do not advocate the burying of trunks for we consider that termites will thereby be increased. More especially is this so in the case of *Coptotermes curvignathus* Holmgr., which by boring from the base through the trunk to the crown is a serious pest to oil palms on some properties. In the present state of our knowledge, we are of the opinion that oil palm trunks should be allowed to decay on the surface. They should, however, be regularly examined with a view to scattering as much of the decayed portions as possible, and to destroying all stages of the Black or Rhinoceros beetle (*Oryctes rhinoceros* (L.) and those of the Red-stripe weevil (*Rhynchophorus schach* Oliv.), remembering that the last-named insect is attracted to a palm 2 days after felling, that it has completed its life-cycle in 87 days and that in 2 months it may have set up suitable conditions for *Oryctes*. The black beetle has completed its life-cycle in 117 days.

The grubs of *Oryctes* have been found in compost heaps, and material entering into their composition would, under certain circumstances, become suitable for the breeding of *Oryctes*; but this insect should not become evident in compost heaps provided that, when they are being turned, the beetle in all its stages is collected and destroyed.

Grubs of *Oryctes* have not been found in peat as such but when the condition of the peat has been altered it is liable to harbour them. Recently an oil palm estate was visited for the purpose of finding the breeding places of *Oryctes*. The damage to the oil palms was neither severe nor localized but was general throughout the

property indicating that the breeding places were distributed. Grubs were found in the surface layers of the peat which had been changed by the admixture of decayed vegetable matter derived from fallen leaves. This had been laid between the rows of palms, and also at the bases of palms where fallen organic débris had accumulated.

It was suggested that experiments should be inaugurated with a view to ascertaining whether by creating breeding places of *Oryctes* and inoculating them with the fungus, *Metarrhizium anisopliae* Metsch., this beetle would be controlled. We are of the opinion that this fungus only becomes prevalent when *Oryctes* grubs are in an unhealthy state. Furthermore, we consider that proper attention to the disposal of this insect's breeding places will ensure its control and that the creation of breeding places is objectionable.

Damage to oil palm fruits on the ground by giant snails has been reported but our observations proved that they paid attention more especially to the over-ripe fruits. It was suggested that if the collecting rounds of the fruit bunches were expedited trouble from this source would not arise.

Rubber.

Prior to the arrival in December 1940 of the Entomologist, Rubber Research Institute of Malaya, entomological problems were referred to this Department, and in 1939 an officer of this Division was detailed for some 4 months to supervise an investigation directed to obtaining certain information relating to the behaviour of the beetle, *Psilopholis vestita* Sharp, during the period of its emergence. The results from this investigation have been published in the Annual Report of the Rubber Research Institute of Malaya for 1939 (p. 177).

Consignments of grubs were periodically received from managers of estates and while we were certain of the identification of grubs of *Psilopholis vestita* Sharp, we were unable to identify grubs of other species with any degree of certainty. We considered that it was of the utmost importance not only to be in a position to inform the managers of estates of the identity of the grubs received from them but also to know ourselves the species of grubs on which we were accumulating data. The work entailed was extensive since all grubs had to be bred to maturity, some being under observation for almost a year. As a result of that investigation "The Identification of Grubs from Rubber Estates" was published. In this grubs are described and the species of grubs and beetles likely to be met with in rubber areas are illustrated (7).

The scale, *Lepidosaphes cocculi* Green, inflicted considerable damage to about 200 acres of clonal rubber, defoliating P.B. 86, T.J. 1 and R. 393. P.B. 86, however, was the most severely injured. This scale, which is mussel-shaped, brownish, and about 1.5 mm. in length, is difficult to detect. Indeed the damage was originally reported as snail injury. The brownish colour of the scale is conspicuous on the greener parts of the plant, such as the leaf-stems and leaves, but blends with the colour of the branches. In this outbreak, scales had congregated in enormous num-

bers and were practically entirely confined to the branches, where they imbibed the sap, thereby arresting the development of the leaves, promoting leaf-fall and causing "die-back." Spraying with kerosene emulsion was recommended and finally was responsible for the control of this scale. A degree of burning followed its use owing to the imperfect emulsification of the oil. A small defoliated area of R. 393 which was lopped afterwards showed marked recovery.

It is probably not generally realized that there are insects of leguminous and indigenous cover crops which have also been recorded on rubber, and the danger of their migrating from these covers and inflicting damage to rubber is ever present. The grasshopper, *Valanga nigricornis* (Burm.) while causing but little damage to rubber may inflict considerable defoliation to the bush cover, *Tephrosia.* Our records suggest that the adults are general throughout February and they are preceded by hoppers which hatch during November and December from eggs laid in the ground during the drier months of May to August. A decrease in adult *Valanga nigricornis* occurs from about June onwards. *Valanga* is generally referred to by the Malayan public as a locust but this is incorrect for it does not possess definitely developed swarming habits. The Bombay Locust (*Patanga succincta* (L.)) occasionally swarms and this is the only locust which is indigenous to Malaya. On the other hand, the migratory locust (*Locusta migratoria manilensis* Meyen) has on two occasions during the past 30 years been present in Malaya. The first was during the period February 1912 to July 1919 when it spread from Port Dickson into Malacca, Johore and Selangor and finally disappeared, the other was from May 16th. to June 26th., 1930 when it was present in the adult stage at Tebong, Negri Sembilan, where it was confined to an area of some 14 acres of *lalang* grass. The area was broadcasted on two occasions with a poison bait and since that time the insect has not visited Malaya. It is considered that Malaya being within the Pacific Locust Zone, *L. migratoria manilensis* is an importation, probably from Borneo, not however by transportation but by flight, and may visit Malaya when outbreaks are in progress in other countries in the Pacific ([8]), particularly when winds are favourable to its flight.

Tea.

Wherever tea is cultivated on the Highlands, the young leaves are liable to be damaged by species of *Helopeltis* and where this occurs the tea is said to be suffering from "mosquito blight." Tea is cultivated in the Lowlands and Highlands of Malaya but whereas species of *Helopeltis* are present in the Lowlands, they have not been recorded on lowland tea. On the other hand, *Helopeltis cinchonae* Mann and *Helopeltis bradyi* Waterh. periodically damage highland tea severely. Whenever *Helopeltis* has been reported damaging tea, observations have been made and measures for its control instituted, but, on account of the disappearance of *Helopeltis,* progress has been considerably limited. Mr. N. C. E. Miller, Entomologist, has endeavoured to correlate the incidence of *Helopeltis* with weather conditions, such as rain and wind, to study the influence of the proximity of the jungle in

relationship with the increase of *Helopeltis* in a tea area, and to ascertain whether there was any connexion between shade and populations of *Helopeltis* and the reason for the prevalence of *H. cinchonae* in one and *H. bradyi* in another area, but definite conclusions on these subjects have not yet been reached. In addition, spraying with several insecticides for the control of *Helopeltis*, studying the life histories and habits of the two species, and importing lowland predators have been or are in progress. An outbreak of *Helopeltis* abated by the middle of 1940 and, since that time, hand-collection of the bugs and the introduction of predatory Reduviids with a view to keeping down *Helopeltis* population, have been continuous. The Reduviids, *Endochus cameronicus* Miller and a species of *Isyndus* and of *Euagoras*, had been recorded as predators on *Helopeltis* at Cameron Highlands and representatives of these were brought from Cameron Highlands, bred in Kuala Lumpur and their progeny sent to Cameron Highlands for liberation in the tea area. In addition, the lowland Reduviid species, *Sycanus leucomesus* Walk., *Isyndus heros* F., *Cosmolestes picticeps* Stal., *Euagoras plagiatus* Stal. and *Rhinocoris marginellus* Thunbg. were bred and introduced into Cameron Highlands. At the end of 1940, Mr. Miller examined the area in which these Reduviids had been liberated and recovered the first three mentioned lowland species indicating that they may have become established.

Several caterpillars of various moths have been reported damaging tea but they are not of great importance and are effectively controlled.

Observations show that the tea bushes, especially those requiring manurial treatment, those suffering from die-back or those injured by injudicious or careless pruning are liable to the attacks of *Microtermes pallidus* (Hav.) ([9]). If, however, the plants are healthy and maintained in a vigorous condition, they will not become subject to attacks by this termite.

Coffee.

Since information concerning *Cephonodes hylas* (L.) (the Coffee Hawk Moth) ([10]), *Stephanoderes hampei* Ferr. (the Coffee Berry Beetle Borer) ([11]) and *Lecanium viride* Green (the Green Coffee Scale) ([12]) was published we have received few enquiries relating to the pests of this crop.

The coffee berry beetle borer is an importation and when it was first recorded in Malaya caused considerable concern. Time has, however, proved that where the harvesting of berries is frequent and the destruction of all fallen berries systematically adopted, this pest is reduced to one of minor importance. All black berries on a bush were considered to be due to this borer, but we are of the opinion that sun-scorch may play an important rôle in their formation.

The encircling of coffee bushes with bands on which has been spread a tanglefoot, thereby preventing ants ascending the bushes to attend the green scale, has shown promise in controlling *Lecanium viride* but these bands should be inspected regularly and if necessary removed so as to avoid disease due to an accumulation of damp beneath the band damaging the trunks.

The "planting" of "kerenggas" (red ants) on coffee bushes for the control of *Cephonodes hylas* (L.) has come to our notice. We doubt whether *Oecophylla* devours healthy caterpillars of *Cephonodes* and are, therefore, sceptical as to its control of this hawk moth. We certainly do not recommend this measure since where this was being practised we observed a considerable increase in green-scale population accompanied by an unhealthy appearance of the bushes. The injury to bushes was so marked that measures to destroy *Oecophylla* and *Lecanium* had to be instituted.

The destruction of "Kerenggas" (*Oecophylla smaragdina* F.) on coffee bushes is effected by blowing a small quantity of Paris green or lead arsenate into a nest; the former kills its occupants in about 3 days and the latter in about 5 days.

Fruit.

The Mediterranean Fruit Fly, (*Ceratitis capitata* (Weid.)), has not been recorded in Malaya, but we are of the opinion that it must have been conveyed in fruit imported into Malaya, and that it has failed to become established because the attractive agent within Malayan fruits is wholly lacking or insufficiently developed. On the other hand, the fruit flies, *Chaetodacus ferrugineus* (F.), *Chaetodacus cucurbitae* (Coq.), *Chaetodacus caudatus* (F.) and *Chaetodacus umbrosus* (F.) are present in Malaya and have been and are under investigation. These names are those which have been used in previous Malayan literature and are retained, but recent studies indicate that they may have to undergo a revision.

A preliminary paper was published recently by Miller ([13]) on certain aspects of these fruit flies and there is therefore little need for describing the investigations and enumerating the control measures in detail. These fruit flies have a wide range of host plants, but in general *C. ferrugineus* is mostly bred from fruits, such as oranges, limes, carambola, *C. cucurbitae* and *C. caudatus* from cucumbers, pumpkin, gourds, while *C. umbrosus* appears to be essentially a pest of the jack fruit and its allies. Fruits of different hosts being available throughout the whole year and holdings in general consisting of mixed plants militate against controlling successfully these insects. In other parts of the world, considerable reliance for the control of fruit flies is placed on cultivating a plant as a sole crop and creating a "dead" season when alternative hosts are not available. Cooperation between owners of contiguous properties to apply control measures should be encouraged for the efforts of one may be frustrated by the apathy of another.

Measures to reduce damage by fruit flies comprise enclosing the fruit with muslin or similar material, destroying not only fallen fruits but also those damaged by flies on the tree, and employing poison baits and/or sprays. Experiments with attractants have been made in Malaya, and Jarvis bait, composed of $\frac{1}{8}$ fl. oz. vanilla essence, $\frac{1}{2}$ fl. oz. Scrubbs ammonia and 26 fl. ozs. water, and formalin bait consisting of $\frac{1}{8}$ fl. oz. formaldehyde solution (40 per cent.), 13 oz. sugar and 26 fl. ozs. water have shown promise, while a spray consisting of 1 oz. sodium silicofluoride, $2\frac{1}{2}$ lbs. sugar and 4 gallons of water has proved effective in reducing fruit fly

infestation. In connexion with the use of fruit-fly sprays, it seems necessary to emphasize that the foliage should be sprayed at weekly intervals during the period that the fruit is susceptible to attack.

In Malaya, while there are six hymenopterous parasites of the larvae of three species of fruit flies and parasites have also been recorded from their puparia, they appear to exercise little, if any, controlling influence.

Pineapples.

The occurrence in Malaya of a wilt of pineapples induced by the mealy bug, *Pseudococcus brevipes* Ckll., has been established experimentally, (v. illustration) but this disease would not appear to be as destructive as in other countries. We are of the opinion that evenly distributed rainfall with frequent heavy storms is one factor limiting the importance of wilt in Malaya. In Hawaii, where wilt is prevalent and destructive, the mealy bugs are usually found in the centre and on the aerial parts of a plant, while in Malaya they are for the most part situated at or just below soil level on the outside of the old leaf bases. The natural position of this mealy bug seems to be that obtaining under Hawaiian conditions for if pineapple plants are protected from rain, mealy bugs tend to migrate to and congregate on the leaves. Mealy bugs are washed from the leaves by heavy rain. They have been observed centrally situated in the accumulations of water at the bases of leaves, and are almost certain to be conveyed to the soil in the overflow of water from the leaf-bases. We consider that rain is responsible for reducing the number and size of colonies, and hence for the fact that mealy bug wilt is of less importance to pineapples in Malaya than in some other countries. Much detailed work of an entomological character has been and is in progress regarding the complex problem of *P. brevipes* in its relationship to wilt. In addition, investigations concerning the greater prevalence of mealy bug wilt amongst pines on mineral than on peat soils, the susceptibility of varieties of pines to mealy bug wilt and the manurial requirements of pineapples to prevent mealy bug wilt have been and are being carried out. Wilt induced by *P. brevipes* has less effect on strong, vigorous plants and, since healthy pines in Malaya are mostly to be found in those areas planted in newly-opened peat land, an important consideration appears to be the conservation of the food material in a soil. The organic matter in a soil may be reduced by fire, sun and rain, and measures whereby its destruction by the first two agents may be restricted are under consideration. For instance, if felling and burning of the jungle were limited, shade would be provided, and the loss of organic matter by oxidation induced by the sun and by fire would be less than would ensue from felling and burning the entire jungle. Before adopting this suggestion, it will be necessary to ascertain (1) whether plants growing under shade will produce fruit of equal quality and quantity to those growing in exposed conditions, (2) whether mineral soils under jungle contain sufficient organic matter and (3) whether the consequent increased exposure (although limited) will not reduce the organic matter sufficiently to permit wilt. It may be mentioned, however, that we have seen areas of pineapples growing and fruiting well under the shade of

Mealy Bug Wilt of Pineapples :—Plants 24 and 29 were planted in peat soil on January 6th. 1940. Plant 24 was not inoculated, but Plant 29 was inoculated with many mealy bugs on May 1st. 1940. The photograph which was taken on September 23rd. 1940, illustrates the effect of mealy bug wilt on Plant 29.

(Photographed by Mr. H. D. Meads, Department of Agriculture).

Root Development of Sarawak Pine in Peat and in Mineral Soil. Both plants were planted in pots of the same size on June 10th. 1940, and treated in a similar manner. On July 14th. 1941, they were carefully uprooted and photographed.

Note — Extensive development of the root system in the pine planted in peat soil and the presence of Tangle-root in the pine planted in mineral soil.

(Photographed by Mr. H. D. Meads, Department of Agriculture).

coconut palms and we have the authority of Johnson (14) for stating that the primitive ancestor of *Ananas* is probably the wild Brazilian pineapple *Ananas microstachys* (Lindl.) and that the structure of *A. sativus* suggests that its original habitat was probably a dry upland forest. Peat areas are not so subject to the removal of top-soil as the steeper slopes associated with granite or quartzite formations in Malaya, where measures should be undertaken to conserve it.

There is, however, another aspect concerning the greater prevalence of wilt on mineral than on peat soils which requires consideration and that relates to the root-system of pines in these soils. Pines growing on mineral soils suffer from tangle-root more than those growing on peat soils, and their root system is not so extensively developed as on peat soils (see illustration). It will be seen, therefore, that with the greater development of the root system a plant has not only a larger field from which to draw its food-material, but would be less liable to suffer from a water shortage. The reddening of plants, which is generally considered a symptom of mealy bug wilt on some mineral soils may not be, therefore, the direct result of mealy bug attack; indeed, it may be due directly to a water deficiency in the soil. Officers of the Field Branch in the Department of Agriculture have frequently reported that the reddening of pines is more pronounced during the drier weather and that a return to a more healthy colour is noticeable during the wetter weather.

Pseudococcus brevipes is controlled effectively in Hawaii by directing a stream of spray into the heart of the pineapple plant, but mealy bugs being usually congregated below ground level in Malaya, spraying has not been successful in controlling them. Even if a successful spraying technique were evolved, the cost of the spraying equipment and material would be prohibitive in view of the market price for pines in Malaya.

Our investigations on pineapple wilt are not complete, but we tentatively suggest that if pineapples were planted in areas where the organic matter had been conserved and maintained and pineapple slips or suckers free from mealy bugs were planted, the incidence of mealy bug wilt would be largely eliminated in Malaya. We further suggest that consideration should be given to limiting pineapple culture to newly-opened up peat areas.

Vegetables.

Snails:—Meta-bran mixtures have proved effective in controlling the Giant Snail (*Achatina fulica* Fer.) but, under certain circumstances, do not appear to be as attractive as has been supposed. We have on many occasions observed snails approach a heap of a mixture and when almost in contact with it, change their direction. The effectiveness of a mixture is influenced by a snail's direction, if it is towards a heap, more snails will be collected at the mixture.

The cigarette-tin receptacle containing a Meta-bran mixture has proved satisfactory, and in Malaya a dry mixture may be considered as effective as a moist one.

Meta-bran mixtures protected from rain remain effective for a period of about 2 months but when unprotected are soon dispersed.

The closer the receptacles or heaps the greater the mortality, and a distance not greater than 5 ft. separating heaps or containers is recommended.

The mortality amongst snails induced by Meta is largely dependent on the extent of the treated area, *i.e.* the larger the Meta-treated area the greater the snail mortality. A Meta-bran mixture of the same quantity and strength broadcast over 1 sq. yd. is more effective than placing it as a barrier of 1 yd. or distributing it in two heaps separated by 1 yd. On the other hand, a mixture broadcast is washed away by rain more readily than when placed in heaps or laid down as barriers.

The effective strength of Meta-bran mixtures for containers or heaps varies according to the conditions to which those snails which have fed upon them are exposed. Snails which have fed upon Meta-bran mixtures may recover under certain conditions and the following strengths of mixtures are recommended where paralysed snails will subsequently be exposed to different climatic factors:

Bright sun	1 gm. Meta to 6¼ lbs. bran.
In the open but during an overcast period	1 gm. Meta to 1¼ lbs. bran.
Under shade, such as cover crops or vegetables ...	1 oz. Meta to 1¼ lbs. bran.
For broadcasting on closely cut grassland during periods of bright sunshine and no rain	2 ozs. Meta to 303 lbs. bran. per acre. (The quantity of bran could be reduced).
As barriers	1 oz. Meta to 1¼ lbs. bran at 1 oz. per yard.

Giant Snails have been found to survive without food and water for a period of 10 months.

Besides the Giant Snail, meta-bran mixtures have proved effective against the following snails and slugs, *Sublina octona* Brug. which is conical in shape and probably the most prevalent snail in gardens, *Hemiplecta crossei* Pfeiffer, *Bradybaena similaris* Fer., *Parmarion* sp. probably *reticulatus* Hass. and *Vaginula* sp. probably *bleekeri* Kef. The last-named is a slug and has been recorded damaging cover crops, destroying rubber buds and shoots and imbibing latex.

Cut-worms:— Prior to the road being opened for traffic to Cameron Highlands reports were received of damage to vegetables by insects, the most notable being "cutworms," generally *Agrotis ypsilon* (Rott.). Poison baits as used in other countries were recommended but reports indicated that they were not successful. Controlled experiments were therefore conducted which proved that poison baits were effective and suggested that the method of their application had been probably at fault. In cooperation with the Entomological Division, the Agricultural Officer, Mr. H. K. Ashby, conducted a series of field experiments and effective results were obtained by broadcasting 4 days before planting out vegetable seedlings a bait com-

posed of 1 lb. Paris green and 20 lbs. bran at the rate of 130 lbs. per acre. Experiments are to be continued with a view to ascertaining whether effective control will will still be obtained when the quantity of the bait per acre is reduced.

Plutella maculipennis (Curt.):—The caterpillar of this moth is an important pest of cabbages in the Highlands, and in association with the Entomological Division, Mr. Ashby and later Mr. B. A. Lowe, Agricultural Officers, supervised experiments for its control. Derris, pyrethrum and nicotine extract sprays were compared and it was found that nicotine extract of 0.1 per cent. concentration with or without the spreader Agral 1 was more effective than either derris or pyrethrum sprays. The plants were sprayed at intervals of 4 days. Nicotine extract having given such satisfactory results, its use against *Plutella* has now become standard practice.

Golf Courses.

At Cameron Highlands considerable attention has been devoted to the bionomics and control of *Anomala shanica* Arr. whose grubs were reported in August, 1935 damaging the turf of the newly-constructed golf course. A survey of the area indicated that the grubs while rendering the turf spongy by their burrowing, were not causing extensive damage to the roots of grass, even in those places where as many as 151 to one sq. ft. of turf were collected, and that they were for the most part confined to low-lying areas where the soil was composed of raw peat. The study of the habits of this insect showed that the beetle has an annual life-cycle, that it commences to emerge from the soil from about the middle of February to the middle of May, though specimens have been collected in June, that it emerges from about 7 p.m. and its flight continues until about 9 p.m., that it rests during the day-time on plants, such as *Melastoma muticum* and the giant tree fern, *Cyathea contaminans*, that when disturbed it feigns death and drops to the ground, that it may remain above ground for 6 days after emergence, and that the grubs are attacked by the fungus, *Metarrhizium anisopliae* Metsch. Investigations were conducted against the grub by incorporating insecticides in the soil, and broadcasting lead arsenate as well as applying several emulsions to the turf. None proved successful in killing the grubs, and the grass was severely burnt after applications of small quantities of lead arsenate. This may have been due to the formation of readily soluble arsenic compounds by the action of organic acids on the lead arsenate. (It may be mentioned that grass growing in a mineral soil is not burnt by moderate applications of lead arsenate). In addition to these lines of investigation, traps containing about 21 different "attractants" and light traps—electric, kerosene and acetylene—were set up with a view to attracting the beetles, and while rose-geranium, eugenol-geraniol and fennel seed oil attracted most beetles in the order named, and electric light more than acetylene and that more than kerosene, the numbers attracted indicated that their use could be justified only as a supplementary control measure.

In view of our observations, we recommended that no peat enter into the formation of Tees and Greens, that they be made from quartzite soil, that the low-lying areas be drained and that as far as possible mineral soil replace the raw peat. In addition, in view of the resting habit of the beetle on the leaves of plants during the

day-time and the beetles after emergence remaining above ground up to 6 days, clearing the undergrowth and allowing certain plants to remain in the "rough" were advised. These recommendations were made to facilitate hand collection of beetles. Our records show that 52,686 beetles were collected in 1936, 18,497 in 1937, 6,550 in 1938, and 1,538 in 1939.

The improvement in the condition of the golf course and the intensive collection of beetles have in our opinion assisted in reducing this insects' population. About 90 per cent. of the grubs collected in 1938 from the golf course were found to be infected with *Metarrhizium anisopliae*. It is considered that this fungus may have become evident owing to the conditions being unfavourable for the healthy development of the grubs.

At Fraser's Hill, the grubs of *Melolontha hastata* Arr. are present, feeding upon the roots of the grass comprising the fairways of the golf course, but the Scoliid, *Campsomeris prismatica* (Sm.), seems to exercise a controlling influence which is sufficient to prevent damage to the fairways.

Derris.

In earlier work a good deal of difficulty was experienced in correlating dosage and mortality of test insects in derris-spraying experiments, and a good deal of trouble was also encountered in dipping tests. The spraying apparatus used in derris work was one of very fine construction and it was thought that possibly the nozzle had become worn. Various tests for distribution were carried out, large paper discs being sprayed with dye to indicate general distribution; caterpillars (*Spodoptera pecten*), selected so as to be as nearly the same size as possible, were sprayed with colloidal iron hydroxide and the quantity of iron on each caterpillar was determined by Dr. T. A. Buckley, Senior Chemist, Department of Agriculture, the iron in unsprayed caterpillars being determined at the same time, and to eliminate differences in surface properties which might be present in living test objects, small discs of gelatine of uniform area, previously rendered grease free, were sprayed with a dye, each disc then being dissolved in a given quantity of water and the amount of dye determined colorimetrically. All these tests indicated that the distribution of the spray was very uneven.

Immersion of insects in insecticidal solutions has certain disadvantages one of which is that the insect may swallow some of the solution thus making it impossible to distinguish stomach from contact effect. In addition, certain caterpillars curl up when wetted and quite large quantities of fluid are retained by surface tension. Caterpillars of *Spodoptera pecten* were dipped in copper sulphate solution and in colloidal iron hydroxide. The former was found to be far too irritant for the experiment but the latter had no apparent effect on the caterpillars. In all cases very large variations in the quantity of iron or copper on or in individual test subjects were found; tests for copper in untreated larvae were also carried out.

Attention was then turned to finding a satisfactory dusting technique. Three main problems appeared to require solution; the method of applying the dust, the question of residual dust not actually falling on the insects under test but being en-

countered by them in their subsequent movements, and the question of controlling the quantity of dust used. In addition there is the very important question of preparing a derris dust sufficiently fine for satisfactory dusting.

Various methods of applying the dust were tried. These consisted of brushing the dust through a fine gauze screen and allowing it to settle on the test subjects at the bottom of a tall cylinder; blowing the dust into the air and allowing it to settle, the operation being carried out in a tall cylinder to exclude draughts and the test insects being placed on a wire mesh tray to allow excess dust to fall through; and by direct pressure application from a small glass container fitted with a glass tube as a dust nozzle. The last-mentioned method was found to give very consistent results. The test insects were placed on a gauze tray at the bottom of a glass cylinder open at both ends and the dust projected directly on to them.

The dust used for preliminary tests was a mixture of rouge and finely divided silica, rouge alone being found to clog the apparatus, and the quantity of iron adhering to individual larvae was determined.

Trials were then made with derris/talc mixtures. At first the dosage was controlled by varying the quantity of derris powder in the mixture but later it was found that the most reliable mixture was one containing 10 per cent. derris dust and 90 per cent. talc, the dosage of derris being controlled by the total quantity of dust used. Very consistent results were obtained and a brief summary of the preliminary trials is given hereunder.

Table VIII.

		per cent.
Type of root Changi No. 3, Moisture (air dry) 7.39 per cent	Ether extract	35.48
	Rotenone	15.01
Dry basis	Ether extract	38.2
	Rotenone	16.2

Test subject *Spodoptera pecten*, larvae 23 — 24 days old.
Number dusted at a time 10.
Total Number dusted 500 and controls 500
Control dust — Talc.

Class range (actual quantity derris powder used)	Mortality after 3 days	Controls
0.0007 — 0.0056 gramme	7.15 per cent.	
0.0057 — 0.0106 "	26.25 "	No deaths
0.0107 — 0.0156 "	37.1 "	
0.0157 gramme upwards	98.4 "	

Note: 2.6 per cent. of larvae died from parasites (*Chelonus* sp.)

Distance Effect of Derris.

Miller, ([15]) 1935, showed that crushed, freshly harvested roots of *Derris elliptica* killed both *Spodoptera pecten* and *Aspidomorpha miliaris* larvae without contact. Further tests in this connexion were made in 1938. Roots of *D. elliptica*, Changi No. 3 and of *D. malaccensis*, Kinta type, both gave positive results. A fresh, water extract of the same roots gave negative results. Negative results were also obtained with dry powdered root, rotenone and rotenone ground to a paste with water. A positive result was, however, obtained with dry powdered root made to a paste with water, but the effect did not develop fully until a day had elapsed and it was not quite so marked as in the case of fresh roots.

Feeding Tests.

Miller ([15]) showed that cockroaches would eat baits containing pure rotenone without harmful effects and that a certain amount of the rotenone passed through the gut in an unchanged condition. Baits containing powdered derris root were, however, unpalatable as were foods steeped in a derris extract. This work was carried one stage further in 1938 by feeding cockroaches (*Periplaneta americana*) with cocoa powder containing toxicarol precursor. No feeding appeared to take place and no deaths attributable to toxicarol precursor occurred. It was observed that toxicarol precursor appeared to inhibit mould growth. Cocoa powder alone was readily eaten.

Household Insects.

Termites.

About the middle of June 1939, a memorandum incorporating information relating to the species of termites in Malaya, the nature of their damage, the methods of protecting woodwork from termite attack and of repairing damage to woodwork of buildings attacked by termites, and legislation against termites was submitted for the consideration of the Secretary of State for the Colonies. In this connexion, contact has been made with several officers of the Public Works Department and of the Forestry Department to whom advice has been given and literature relating to the construction of buildings to prevent termite damage and measures for the destruction of termites in buildings has been supplied.

While on the subject of termites, we have observed that considerable reliance for the control of termites in bungalows and houses in Malaya is placed on introducing an arsenical powder into their runways with a view to the poison being carried by the workers to the nest, thereby exterminating the whole colony. This is an old theory but we doubt whether there is experimental evidence to support it. We admit that termites are poisoned by arsenicals and that colonies of dry-wood species of termites, in view of their circumscribed limits, are more readily exterminated by them than subterranean species. In our opinion, however, arsenicals when introduced into the runways are rarely if ever carried to a colony of a subterranean species of termite in sufficient quantity to exterminate a nest. We have dusted termite

colonies, and the colonies have not been exterminated; we have dusted workers and soldiers on their appearance at the time of the emergence of winged forms without killing the colony; we have introduced so-called poisonous termite baits in the nests to find that the colony has plastered earth around them and segregated them; we have placed a barrier of Paris green along the side of a wall of a cellar where termites without runways were going to and from their fungus gardens to discover later that they had endeavoured to bridge the barrier by a wax-like looking cone about $2\frac{1}{2}$ in. in diameter at its base and 1 in. at its apex projecting at an angle of about 45 degrees at the junction of the wall with the floor; and we have observed a species of termite placed in dishes with damp blotting paper and supplied with dead termites, gather the dead termites into a heap and bury them with pieces of chewed-up blotting paper. With this evidence, we are of the opinion that termites sense the agent responsible for the death of individual members and isolate it as well as their dead, thereby affording protection to the colony. While there is no doubt that poisons injected into runways will kill members of a subterranean colony, there is a considerable doubt as to the entire colony of a subterranean species of termite being destroyed by an injection of a poison in the runways. To obtain maximum effect from the use of poisons, injections into the runways of termites would have to be made at different places and would have to be carried out frequently.

We do not propose to deal with the possible poisoning of humans by the use of arsenicals. In Malaya, free circulation of air is general throughout bungalows and houses and we consider that there is not much, if any, danger from poisoning, but it may be of interest to quote from the Report of the Pacific Coast Committee on Termite Investigations. "The Committee recommends that arsenical preservatives be not used in the treatment of wood, wallboard, building paper, or other material used in dwellings or structures accessible to man, or in or on soil underneath such structures, as a treatment against termites. The arsenic compounds used as preservatives are all highly toxic to man and also present a toxic fume hazard in case of fire. Furthermore, termites and their burrows are universally infested by fungi, including many common moulds. Fungi are also abundant in the soil in which termites live. A number of these fungi turn arsenical compounds into a volatile form, which diffuses through the air and slowly poisons persons breathing it" ([16]).

We recommend that buildings in the first place be so constructed as to prevent termites gaining access to the woodwork and that heart as opposed to sap wood be used. When subterranean termites have obtained access to a building, the point of entrance should be found and the ground drenched with a suitable disinfectant and consideration given to structural alterations to prevent further damage by termites. In this connexion, it should be mentioned that subterranean termites infesting the wood of buildings will die if they are prevented from reaching the ground.

Simplicia caeneusalis Walk. damaging *Atap*.

A report was received in 1940 to the effect that the "ataps" (dried leaves of the nipah palm, *Nipa fruticans* Wurmb.) which were being used extensively as roofing

material for huts were severely damaged by caterpillars. The area was visited and certain recommendations were made. It was recognized that, while treatment of the "ataps" with lead arsenate would be successful in controlling the caterpillars, there was the danger of poisoning humans as a result of the atmosphere becoming laden with small particles of lead arsenate and/or with arsine produced by the action of fungi on the arsenical compound, and the difficulty in applying an insecticide to the *atap* roofs. It was finally decided that the "ataps" before erection be immersed in or sprayed with a non-arsenical insecticide and that those already in position be sprayed with a sprayer having a sufficient pressure to force the spray between the layers of "ataps." The spray recommended was a non-arsenical proprietary fungicide. According to Mr. D. G. Jones, Agricultural Officer, Kinta and Batang Padang, spraying the *atap* roofs was done from the underside and penetration was obtained *in situ* with an "aerograph" spray-gun at a pressure of 25 lbs. per sq. inch. The cost of this spraying was 45.5 cents per 100 sq. feet and 1 gallon of the spray was sufficient for 500 sq. feet of *atap*. While the results at first appeared to be encouraging, the attaps were again attacked where the spray had not penetrated. Experiments are being continued and the immersion of "ataps" in cresol-soap solution according to Mr. T. A. Henderson, Assistant Engineer, Ipoh, shows promise.

Reports from other areas of the destruction of *atap* by this caterpillar have now been received. The cause for the appearance of this moth is not known, but enquiries are proceeding with a view to tracing its origin. It is possible that these outbreaks may be directly attributable to the sudden provision of ideal breeding grounds without the usual smokiness which is produced from open fires, oil lamps and similar sources, and which is generally associated with *atap* huts and also to the heavy demand for *atap* at the present time resulting in large numbers of immature leaves being used and the usual process of soaking the prepared *atap* being omitted.

Ants.

In addition to those household ants which are readily controlled by a sweetened bait, *Camponotus irritans* Sm. is frequently troublesome in wooden bungalows, bathrooms in particular being involved. This ant is usually associated with decayed branches of old trees and bamboo hedges where it attends the scale, *Antonia maritima* Green. The elimination of these two sources assists in reducing the colonies of this ant. We have, however, obtained marked success in controlling it by lightly dusting with Paris green the floor of a shallow tray, brushing ants on to it and allowing them to crawl over the poison and out of the tray. Bungalows have been freed of this ant in a month, but this success was only accomplished by carrying out this measure at least once every two days. We have placed dead ants of *Camponotus* in a heap, and have seen other representatives carrying and dropping them into a drain down which water was running.

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Reviews.

Report on Agriculture in Malaya for the Year 1940.

By W. N. C. Belgrave, B.A., Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States. F.M.S. Government Press, Kuala Lumpur, F.M.S., 1941. 14 pp. Price 25 cents (Malayan Currency) or 7d.

For reasons of economy, the annual report on Agriculture in Malaya, which normally occupies more than 100 pages, is in 1940 condensed to 14 pages. It was therefore obviously impossible for the author to do more than skim the surface of his subject, reviewing the general trend of agricultural progress in the country and indicating the subjects of investigation by officers of the Department of Agriculture. References are given from which the reader may obtain fuller information from the publications of the Department.

The Report, however, succeeds in recording the position of agriculture under war conditions; and also shows that the research work of the Department continued with the minimum of interruption. Furthermore the extensional services of the Department not only maintained the lines of work laid down in peace time but were able to render service in connexion with the drive for increased food production as a war-time measure.

Interest naturally centres around the subject of food production. After detailing the progress made towards increased rice production, Mr. Belgrave remarks that the problem of increasing the production of other foodstuffs is rendered difficult by the reluctance of the population to eat such products so long as rice is available. Peasants have responded well to appeals to plant sufficient for their own limited consumption. "There are similar difficulties," he continues, "in effecting any great increase in the production of market garden vegetable produce in anticipation of any expected restriction of imports. In the case of such vegetable produce, however, there would be only a short lag between any marked increased demand and increased supply from local production. The increase which has taken place in vegetable production is probably nearly as great as the market can absorb without a fall to unremunerative prices in the absence of any marked further restriction of imports."

Coconut Recipes.

Second Edition. Published by the Malayan Agri-Horticultural Association, Kuala Lumpur. 88 pp. Price 50 cents (Malayan currency).

The appearance of a second edition of this book is opportune owing to the desirability of making full use of local food resources and to the fact that the coconut growers need every help they can obtain during the present depression in this industry.

The present edition has been revised by Mr. H. L. Barnett, who has introduced several new features which add to the value of the compilation. The book not only contains over 100 recipes, but two useful chapters; the Coconut Palm as a Source of Food by Mr. F. C. Cooke, and Copra Cake Meal by Mrs. Morag Llewellyn. The latter contributor advocates the employment of copra cake meal as a substitute for varying quantities of wheat flour in the preparation of certain foods. Copra cake has superior keeping qualities to those of flour, the cost is less than a fifth of that of imported flour, while the food value of copra cake meal is higher than that of flour.

Among Mr. Cooke's suggestions for the use of coconut is the preparation of coconut honey, which he considers to be a product having distinct commercial possibilities.

The Director of Agriculture, in a Preface to this edition, states:— "..... the coconut is highly nutritious food, and perhaps unique amongst foodstuffs in that it is cheaper now than before the outbreak of the war. For these reasons alone, a wider use of the coconut should commend itself to the housewife."

The excellence of this little book and its modest price should ensure it a ready sale, not only in Malaya, but wherever coconuts are readily and cheaply available.

D. H. G.

Malayan Agricultural Statistics 1940.

By D. H. Grist. Special Bulletin, Economic Series No. 12, Department of Agriculture, Straits Settlements and Federated Malay States. 106 tables, 2 graphs. 1941. Price $1 (Malayan currency) or 2s. 4d. post free.

This publication presents in a convenient form comprehensive statistics relating to Malayan agriculture; areas, yields, imports and exports, market prices, meteorological data and customs duties. For the more important crops, production figures are given over a number of years while annual import and export figures are in most cases given for the past 18 years. This comprehensive compilation is assured of wide appreciation.

In his preface the Director of Agriculture refers to the fact that the author, an officer of his Department, also holds an official position in the Statistics Department, and considers that this close co-operation, which has worked smoothly for the past ten years, has been to the advantage of both Departments, for, he continues, "It has enabled us to organize the collection and compilation of comprehensive statistics relating to Malayan agriculture, information which is of the greatest use departmentally, and which experience has shown to be appreciated by the public."

Notes and Comments.

MALAYAN AGRICULTURAL LITERATURE.

Literature in Malaya with a bearing on agriculture is extensive. We have, within the past few weeks, received the following publications, all published in Malaya:— The R.R.I. Planters Bulletin, The Journal of the Rubber Research Institute of Malaya, The Gardens' Bulletin Straits Settlements, The Malayan Forester, The Journal of the F.M.S. Museums, The Planter, The M.A.H.A. Magazine, The Malayan Nature Journal, Coconut Recipes, published by the M.A.H.A. Association, and Malayan Fish and how to cook them, published by the Department of Information and Publicity. To this list we might add the publications of the Department of Agriculture, *viz.*: The Malayan Agricultural Journal, the Chinese Agricultural Journal, Warta Perusa'ahan Tanah (the Malay Journal), the Tamil Agricultural Journal, a book on "Vegetable Gardening in Malaya" and a Leaflet on "Cattle Keeping".

Truly a formidable and catholic list, which makes one wonder whether this spate of literature is justified, whether in fact the Malayan public is a reading public. Certain of the above publications are distributed free and it is therefore impossible to tell by their circulation figures the degree of attention they command. Others are of great scientific interest and therefore base their value on their contribution to scientific knowledge; others are published for propaganda purposes, while the remainder are directed to readers with a restricted interest. Such being the case, the value of a publication, especially of a scientific or semi-scientific nature, cannot be judged on circulation figures.

Malaya is still in an early stage of development. It contains a cosmopolitan population, whose interests are equally cosmopolitan. It is obviously the aim to encourage development in all directions, and especially in new directions, and to achieve this object it is essential that any and every branch of agriculture should be adequately served with information likely to prove of value.

An attempt was made some years ago to standardize the Government scientific publications, but the project fell through, probably because of the opposition of the Departments concerned. Such standardization has little to recommend it and much that is not in its favour. The link between the publisher and the reader is slender and depends very much on the characteristic format of the journal and the method of presentation of the articles. Individuality, then, is of value, and for this reason the multiplicity of local publications is justified.

The edict has gone forth that the development of the Colonial Empire shall continue with as little interruption as possible from war conditions. It is therefore a matter of congratulation that in Malaya this steady issue of reading matter should continue, to bear evidence of the continuation of research work despite war conditions, and to maintain the advisory service to those engaged in the development of the vast resources of Malaya.

Departmental.

OBITUARY.

ARTHUR BERNARD LUCY, B.SC., A.R.C.S., A.I.C.T.A.

It is with deep regret that we record the death at the age of 29 of Mr. Bernard Lucy at Kuala Lumpur on the 19th August 1941 after a short illness.

Mr. Lucy was educated at Sutton Valence School, from which he proceeded to the Imperial College of Science and Technology where he had a distinguished career, gaining 1st Class Honours (Special) in the B.Sc. examination at the University of London and the Associateship of the College (A.R.C.S.). He was granted a Colonial Agricultural Scholarship and spent one year at Cambridge University followed by a year at the Imperial College of Tropical Agriculture, Trinidad, where he was awarded the A.I.C.T.A.

On 10th September 1937 Mr. Lucy was appointed to be an Agricultural Officer, Department of Agriculture, S.S. and F.M.S. Since his assumption of duty with this Department he had been stationed at the Central Experiment Station, Serdang.

Mr. Lucy was well qualified by his training and temperament for successful research work, and in the comparatively short time he was in this Department he gave abundant evidence of his ability in this direction. Research demands not only knowledge, but infinite patience and meticulous care; these were characteristics of Mr. Lucy, who spared no pains in the preparation and execution of his work.

During the past three years the pages of this Journal, and our knowledge of Malayan agriculture, have been enriched by six original articles from his pen, recording his field investigations, while his name has been associated with others in the authorship of two further original articles in this Journal. Thus in a short time Mr. Lucy established himself in the field of agricultural investigation and leaves a useful record to mark his all too brief career.

His nature was quiet, but he made many friends, not only in this Department, but in the F.M.S. Volunteer Force, of which he was a member, and in other directions. His untimely death has come as a great shock to us all, and we are sure that his friends elsewhere will wish to associate themselves with his colleagues in the Department of Agriculture in extending to his relatives our sincere condolences in a loss which we share with them.

Meeting of Agricultural Advisory Committee, August 13th 1941.

A meeting of the Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on August 13th 1941, when the various aspects of a number of agricultural problems engaging the attention of the Department were discussed. The following are some of the more important points taken from the minutes of the meeting:—

Soil Erosion. Among the recommendations of the Soil Erosion Committee at a recent meeting was the formation of Catchment Boards to direct and co-ordinate action in all matters regarding soil erosion.

Rubber. Departmental Agricultural Stations will shortly have a total of 62 acres of budwood nurseries in addition to which a central Station of 150 acres is being established at Sungei Buloh by the Rubber Research Institute on behalf of participating Administrations. Progress is satisfactory and some of the areas on Stations can now supply budwood. Agreements have been made with owners of proprietary clones for their use and distribution to small-holders.

The Pineapple Industry. It is now nearly impossible to sell canned pineapples in quantity. The Ministry of Food has ceased to buy this product. The possibility of establishing new markets in New Zealand, India as well as with the Forces and elsewhere is being tried. Canned pineapples are on sale in some canteens but are nowhere included in the standard army rations. Some supplies have been sent to the Middle East.

The Ministry of Food is prepared to take pineapple jam and one factory has installed extra machinery for its manufacture. One factory has started to produce pineapple juice as a beverage. It is hoped that it may become popular locally and find an export market.

Hevea spruceana. A certain number of plants of *Hevea spruceana* have been imported for use as stock for vegetative reproduction. The latex of this plant is reported to have undesirable properties and, in view of the danger of spread of the species or of hybrids with *H. braziliensis* it has been agreed that planting should be very strictly controlled. Legislation to effect this control will shortly be submitted to all Legislatures in Malaya.

Release of Officers for War Duties.

In response to a circular from the Secretary of Defence for the names of officers who might be released from the Department of Agriculture for war service, the names of seven officers have been forwarded for release immediately, and in addition the names of two officers subject to recall in the event of casualties in their respective Divisions.

Effect has already been given to this recommendation and two officers have now been seconded for special duties.

Visit of Mr. F. C. Cooke to Sarawak.

At the request of the Sarawak Government, Mr. F. C. Cooke, Chemist Industrial Processes, visited Sarawak during the period June 4th to 15th, 1941, for the purpose of reporting on the copra industry in that Colony.

Leave.

Mr. J. Fairweather, Agricultural Officer, returned from leave on 22nd July 1941.

Mr. A. Thompson, Senior Plant Pathologist, returned from leave on 21st August 1941.

Mr. N. C. E. Miller, Entomologist, returned from leave on 21st August 1941.

Dr. T. W. Brown, Botanist, has been granted 150 days leave from 23rd July 1941.

Mr. P. G. J. Dobree, Personal Assistant to the Chief Field Officer, has been granted 3 months leave from 18th August 1941.

The Chinese Agricultural Journal.

Volume XII No. 3 of The Chinese Agricultural Journal has just been published in the Chinese language. In view of the importance of increasing the production of foodstuffs in Malaya this number should have a wide appeal for it includes articles on pig keeping, yams, the papaya and mulching. Copies may be obtained free of charge by residents in the Straits Settlements or Federated Malay States. The price to residents outside this area is 15 cents per copy, post free. Applications should be addressed to the Agricultural Economist, Department of Agriculture, Kuala Lumpur.

FERTILIZER PRICES, AUGUST, 1941.

The following are the prices current for the month of September 1941 of the more important fertilizers of which stocks are available.

	per ton $	
Nitrate of soda	185	
Rock phosphate (Christmas Island)	40	($36 Singapore).
Lime	15	

Quotations are *ex* warehouse, Port Swettenham, Klang, Singapore and Penang.

Supplies of muriate of potash, sulphate of ammonia, superphosphate, basic slag, calcium cyanamide, sulphate of potash, and rock phosphate (Gafsa) are not available.

FROM THE DISTRICTS.

Compiled in the office of the Chief Field Officer from Monthly Reports of Agricultural Officers.

August, 1941.

The Weather.

Rainfall during August was slightly below the average for the Peninsula. With the exception of some inland areas which experienced very dry, hot weather throughout the month, the lack of rain earlier in the period gave way to heavy precipitation at its close.

In Brunei and Labuan, rainfall was well below the average.

Crop Reports.

Rubber. — The price of couponed rubber remained steady throughout the month at an average of $45 per picul for smoked sheet. The price of coupons, however, fell sharply to $5 to $7 per picul equivalent in anticipation of an increased quota for the next quarter, resulting in a corresponding rise to $33 to $35 per picul for uncouponed rubber and a considerable increase in tapping. The fall in price of coupons has led to the cessation of replanting among small holders.

Many districts continue to report an acute shortage of coagulants, and there appears to be no easing of the situation. Complaints of adulteration of acetic acid with hydrochloric and sulphuric acids, and of prices being charged in excess of the gazetted legal maximum, continue to be frequent.

As far as limited stocks have allowed, issues to small holders from Departmental sources have been made.

In South Perak it is reported that large numbers of applications for dealers' licences have been received, apparently due to the misconception that these licences will enable their holders to obtain supplies of acetic acid.

Padi. — In North Kedah, planting is in full swing; reports from Sanglang and Perlis tell of unusually severe rat damage, especially to nurseries. It is suggested that clearing of jungle on areas being newly brought under cultivation may be partly responsible.

In Province Wellesley, planting has been very uneven, the South and East being short of water while the North and West have had sufficient. In Penang, cultivation is almost complete.

In North Perak weather conditions improved during the month in favour of padi planters and the supply of water to the fields was plentiful.

In Krian, conditions were very critical by the middle of the month and the reservoir was empty, but timely rain saved the situation and by the end of the month all areas had enough water, in fact in the new coastal area several nurseries suffered severely from floods.

Transplanting is well advanced in several areas in the North. Rat hunts were organized in all districts except Selinsing and Semanggol and 25,000 rats were destroyed.

In the Kuala Kangsar District, water appears to be sufficient, nurseries are well established and cultivation of fields is in progress. In Upper Perak it is reported that about 700 acres of dry padi have already been planted and that a further 500 acres is being prepared for planting.

At Sungei Manik clearing is well in hand in Stage I, and in Stage II nurseries have been broken up and some planting-out started. In Stage III clearing is partly completed and wet nurseries are reported healthy, although bird damage has occurred in dry nurseries. Short term varieties of padi have been planted in Stage IV.

In the Kinta District planting has commenced in several areas and it is notable that many cultivators in the Teja *bendang* are now using slime water for irrigation purposes as a direct result of last year's experiment.

In Kelantan, the recent dry weather has left many localities short of water and very little transplanting has been done.

In the Raub District of Pahang, the areas which had irrigation water were ahead of schedule and transplanted during the month; elsewhere, however, the fields were very hard and dry and cultural operations were held up. Planters in the riverine swamps of the Lipis District are not expecting a good crop although a fair yield of well filled grain has been harvested at Sempalit.

Transplanting in Paya Besar and other areas in East Pahang is in progress and the water supply has been more than adequate; in the South of the State a serious outbreak of rat damage has been reported from the riverine mukims and 180 packets of barium carbonate have been distributed, in addition to rat traps.

In Selangor, a wide variation in planting dates from *mukim* to *mukim* is reported from the Ulu Langat and Kuala Lumpur Districts; for example the crop in the Ulu Gombak area is in flower whereas at Merbau Lempak transplanting is not yet completed.

Transplanting has been completed practically throughout Negri Sembilan and in the Jelebu District the first weeding is in progress; the prospects for harvest in this District appear to be better than last season.

In the Jasin and Alor Gajah Districts of Malacca all planting has been completed and the crop is very promising. Reports of acid water killing nurseries have been received from parts of the Coastal and Central Districts.

In North Johore it was noticed that the very remunerative price of rubber caused a lack of interest in padi cultivation and a number of instances of owners failing to cultivate their fields was reported to the Land Office.

At Ulu Senggarang in the Batu Pahat District, rats and birds are reported to be doing considerable damage. In the Endau District preparation of the land for transplanting is being carried on in a rather haphazard fashion and padi planters are not giving the land sufficiently thorough cultivation.

In Brunei and Labuan, the unusually dry weather has held up cultivation operations but there is no cause for anxiety.

Tobacco. — Prices generally showed a slight downward trend, though Malacca reported an improvement of $10 to $15 per picul.

All centres report a continued increase in the acreage under this crop.

Coconuts. — The position of the copra industry remains unchanged, though slight increases in the price of copra and nuts are reported.

Livestock. — A general appreciation in the price of pigs occurred during the month and $28 to $30 per picul liveweight is now being paid.

A survey of the goat population in the Kuala Langat area showed an increase from 4,550 to 11,312 since 1939.

Vegetables. — A fairly general increase in interest and planted acreage continues, and supplies are reported to be plentiful.

Corrigendum.

Malayan Agricultural Journal Vol *XXIX* No. 8. August 1941, page 335, 25th line, for "acres" read "daerah (districts)."

Statistical.

MARKET PRICES.

August, 1941.

Rubber.—The Singapore market was very stable during the month, fluctuations not exceeding $\frac{1}{8}$ cent. No. 1. X. Ribbed Smoked Sheet opened at $38\frac{5}{8}$ cents per lb. and closed at the same figure, after falling to $38\frac{1}{2}$ for the greater part of the month. The average of daily quotations for the month was 38.53 cents per lb., as compared with 38.56 cents in July.

The London daily price rose slightly during the month, opening at $13\frac{1}{2}$ pence per lb. and closing at $13\frac{5}{8}$ pence. The New York price, on the other hand, showed a tendency to fall, opening at $22\frac{7}{8}$ cents gold per lb. and dropping to $22\frac{3}{8}$ with a slight rise to $22\frac{1}{2}$ on 31st August. The London average price was 13.58 pence per lb., and the New York 22.55 cents gold as compared with 13.36 pence and 22.05 cents gold in July.

Prices paid for small-holders' rubber at three centres during the month are given in Table I.

Table I.

Weekly Prices Paid by Local Dealers for Small-Holders' Rubber, August, 1941.

(Dollars per picul of 133 1/3 lbs.)

Grades	Kuala Kangsar, Perak				Kuala Pilah, Negri Sembilan			Batu Pahat, Johore.		
	6	13	20	27	7	14	28	6	14	20
Smoked Sheet ...	44.00	44.61	44.39	45.00	45.00	44.40	45.30	—	—	—
Unsmoked Sheet ...	40.95	40.00	42.00	40.00	—	—	—	41.18	38.10	41.20
Scrap ...	—	—	—	—	—	—	—	—	—	—

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul; by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8 per ton.

Transport from Batu Pahat to Singapore by lorry, excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

No purchases at Kuala Pilah on 21st August, and at Batu Pahat on the 27th August.

Table II.

Singapore Prices of Various Agricultural Products.

Product	August, 1941			July, 1941	Average Price 1940
	Highest	Lowest	Average	Average	
	per picul $	per picul $	per picul $	per picul $	per picul $
Copra :					
Sundried ...	2.80	2.65	2.66	2.58	3.08
Mixed ...	2.55	2.40	2.41	2.33	2.76
Coconut Oil ...	—	—	10.00‖	9.25‖	8.29
Copra Cake No. 1 ...	2.55	2.55	2.55	2.55	1.43
No. 2 ...	2.30	2.30	2.30	2.30	‡
Pineapples, Canned :*					
G.A.Q. : Cubes ...	4.85	4.85	4.85	4.85	4.85
Sliced ...	4.80	4.80	4.80	4.80	4.80
Tall ...	4.95	4.95	4.95	4.95	4.95
Golden : Cubes ...	5.45	5.45	5.45	5.45	5.45
Sliced ...	5.40	5.40	5.40	5.40	5.40
Tall ...	5.55	5.55	5.55	5.55	5.55
Coffee :					
Liberian ...	18.00	17.50	17.75	17.50	16.10
Excelsa ...	15.00	14.50	14.75	14.50	13.69
Robusta ...	13.00	12.50	12.75	12.30	8.92
Palembang ...	21.50	18.75	19.13 - 21.13	18.10 - 21.00	13.00†
Sourabaya ...	24.00	21.50	21.75 - 23.88	21.07 - 23.25	14.80†
Arecanuts :					
Best ...	12.50	10.50	11.40	9.81	5.65
Medium ...	11.50	10.00	10.60	9.31	5.24
Mixed ...	10.50	8.00	9.20	8.87	4.88
Splits ...	15.75	9.50	10.38 - 13.19	7.64 - 10.45	6.33†
Red Whole ...	16.75	12.50	13.06 - 15.25	13.15 - 15.00	6.67†
Sliced ...	28.25	18.50	21.06 - 24.75	18.70 - 21.95	10.79†
Pepper :					
Singapore Black ...	8.12½	8.00	8.02½	7.34	7.29
Singapore White ...	16.50	15.50	16.00	14.31	‡
Muntok White ...	17.25	16.00	16.55	15.44	13.51
Nutmegs					
110's ...	28.00	23.25	27.05	21.19	26.11
80's ...	30.00	25.00	29.00	24.00	30.65
Penang, dried¶ ...	—	—	17.00	15.00	21.00
Mace :					
Siouw ...	‡	‡	‡	‡	‡
Amboina ...	55.00	45.00	53.00	39.25	39.85
Penang, dried¶ ...	—	—	45.00	40.00	63.50
Cloves :					
Zanzibar ...	42.50	41.00	41.70	41.00	‡
Amboina ...	43.00	42.00	42.60	42.00	‡
Penang, dried¶ ...	‡	‡	‡	‡	72.00

* per case of 48 cans of 1½ lbs. each. † Highest of the average monthly range quotations.

¶ Penang prices. ‡ Not quoted ‖ In new drums

Product	August, 1941			July, 1941	Average Price 1940
	Highest	Lowest	Average	Average	
	per picul $	per picul $	per picul $	per picul $	per picul $
Gambier:					
Block ...	‡	‡	‡	‡	‡
No. 1 Cube ...	12.50	12.50	12.50	12.50	15.00
Sago:					
Pearl ...	8.75	8.37½	8.62½	8.39	7.79
Flour, Sarawak Fair ...	5.25	4.25	4.85	4.26	4.95
Tapioca: ...					
Flake Fair ...	9.00	7.50	8.50	6.81	8.08
Seed Pearl ...	11.00	9.90	10.48	9.13	9.45
Medium Pearl ...	11.50	10.00	10.90	8.75	9.07

Palm Oil.—No recent information is available regarding prices paid in the United Kingdom for Malayan palm oil.

Local sales of palm oil in sellers' drums were made during August at the following prices per ton:— bleached oil 5 per cent. f.f.a., c.i.f. Colombo $220; unbleached oil 5 per cent. f.f.a., f.o.b. Singapore, delivery during August 1941, $182.50; unbleached oil 5 per cent. f.f.a., f.o.b. Port Swettenham, monthly deliveries January/December 1942, $190.

Rice.—The Singapore average wholesale prices of rice per picul in August were as follows:— Thailand Broken 1st Grade "A" $7.02, Thailand Broken 2nd Grade "A" $6.77, Burma S.Q. Meedone $6.67, Burma Parboiled Milchar No. 2 $5.79. Thailand 3rd Grade "A" and Annam White Rice No. 1 were not quoted.

The June average retail price of No. 2 Thailand rice in Singapore was 51 cents per gantang (gallon). Penang and Malacca prices were not quoted.

The average declared trade value of imports during June was $6.54 per picul, as compared wtih $6.22 in May.

Padi.—The Government Rice Mills, Perak, are paying a guaranteed price of $2.50 per picul for pure strains S.K. 48 padi. There were again no purchases of padi at the Government Rice Mill, Temerloh, Pahang.

Retail prices of padi in cents per gantang (gallon) were as follows:— Penang and Province Wellesley 13; Perak Central 15 to 18, (Parit) 20 to 25, Perak South 14 to 17, Kinta and Batang Padang 18 to 20; Selangor (coast districts) 12 to 15; Pahang North 20 to 24, Pahang South 23 to 24; Kelantan 19; Malacca 18 to 20.

Tea.—There are no London tea sales.

The latest Colombo prices available, quoted from *The Ceylon Tea Market Report* of 19th August 1941 of the Colombo Brokers' Association are as follows, in rupees per lb.: High Grown Rs. 1.49, Medium Grown Rs. 1.43, Low Grown Rs. 1.34.

Cardamoms.—Green Cardamoms were quoted in *The Ceylon Chamber of Commerce Weekly Report* of 18th August 1941, from Rs. 2.34 to Rs. 2.65 per lb.

Derris.—There were no alterations of price level in the commodity during the month. Average prices for August per picul were as follows: $10.50 to $12 for roots sold on a basis of ether extract; $19.50 to $24 for roots with 4 to 5 per cent. rotenone content, rising to $28.50 to $30 for 7 to 9 per cent. rotenone.

Tobacco.—Prices of prepared tobacoo per picul in Kelantan were: 1st quality $120 to $150, 2nd quality $100 to $120, 3rd quality $90 to $100. Prices of dried leaf per picul were as follows:— Penang and Province Wellesley 1st quality $52 2nd quality $41, uncured $7; Kedah 1st quality $62 to $65. Perak Central 1st quality $60 to $80, 2nd quality $50 to $55, 3rd quality $30 to $42; Perak South 1st quality $70 to $85, 2nd quality $55 to $75, 3rd quality $35 to $70, prepared tobacco $1.28 to $1.50 per kati; Pahang North 1st quality $75 to $90, 2nd quality $60 to $80, 3rd quality $39 to $70, Pahang South $30 to $48; Malacca $60 to $65; Selangor cut tobacco $1.50 to $2.00 per kati.

The above prices are based on London and Singapore daily quotations for rubber, on the Singapore daily prices for copra, on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports and certain coffee prices are kindly supplied by Guthrie & Co., Ltd., Kuala Lumpur, local palm oil prices by Whittall & Co., Kuala Lumpur, the Singapore prices of imported coffee and arecanuts by Lianqui Trading Company of Singapore, and Singapore derris prices by Hooglandt & Co., Singapore.

1 picul = 133 1/3 lbs. The dollar is fixed at 2s. 4d.

Note. — The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Trafalgar Square, London, W.C.2.

MALAYAN AGRICULTURAL EXPORTS, MAY, 1941.

Product	Net Exports in Tons				
	Year 1940	Jan./May 1940	Jan./May 1941	May 1940	May 1941
Arecanuts ...	43,915	20,603	18,220	5,167	1,555
Coconuts fresh†‡ ...	131,469†	35,476	91,586	8,316	18,469
Coconut oil‡ ..	69,446	29,404	34,714	7,690	7,378
Copra‡ ...	9,904*	3,066	19,472*	1,597	3,919*
Copra cake ...	1,215*	4,199	5,871*	102*	48*
Gambier, all kinds ...	821	495	123	239	93
Palm kernels ...	9,219	4,119	1,700	750	—
Palm oil ...	55,990	19,718	19,954	4,900	5,428
Pineapples, canned ...	40,243	21,851	611,126	4,948	3,160
Rubber¶ ...	549,327¶	216,029¶	237,976¶	41,140¶	44,290¶
Sago,—flour ...	2,525	506	1,512*	671	958*
,, —pearl ...	4,848	364	2,975	317	611
,, —raw ...	4,816*	448*	1,755*	616*	609*
Tapioca,—flake ...	762	119	279	85	62
,, —flour ...	2,649*	265*	710*	325*	250*
,, —pearl ...	17,004	1,776	8,664	1,934	2,057
Derris ...	1,258	150	412	63	100
‡Copra equivalent ...	108,468	51,024	38,770	14,135	8,440

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS

(In long tons, as declared by Estates).

Month 1941	Palm Oil			Palm Kernels		
	F.M.S.	U.M.S.	Malaya	F.M.S.	U.M.S.	Malaya
January	1,872.7	1,221.4	3,094.1	170.3	150.0	320.3
February	1,698.3	993.2	2,691.5	167.1	179.3	346.4
March	2,179.8	1,710.1	3,889.9	180.5	274.9	455.4
April	1,993.0	1,870.8	3,863.8	176.3	204.0	380.3
May	1,878.0	2,022.3	3,900.3	95.2	219.0	314.2
June	2,763.7	2,173.9	4,937.6	63.0	214.0	277.0
July	3,164.9	2,611.9	5,776.8	44.7	141.0	185.7
Total	15,550.4	12,603.6	28,154.0	897.1	1,382.2	2,279.3
Total January to July 1940	15,602.1	15,722.9	31,325.0	2,926.0	3,144.3	6,070.3
Total for the year 1940	29,875.2	28,096.9	57,972.1	4,513.1	5,098.1	9,611.2

Stocks on estates as at 31st July, 1941 were: palm oil 6,503 tons, palm kernels 1,835 tons.

ACREAGES OF TAPPABLE RUBBER ACTUALLY TAPPED AND NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 31ST JULY, 1941.

STATE OR TERRITORY	Estimated Acreages of Tappable Rubber (9) + (11)	ACREAGES OF TAPPABLE RUBBER NOT TAPPED				Area of tappable rubber never been tapped (b)		Total area not tapped (3) + (5) (c)		TOTAL AREA TAPPED DURING THE MONTH		Area of tappable rubber rested under rotational systems (c)	
		On estates which have entirely ceased tapping		On estates which have partly ceased tapping (a)									
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)	Acreage	Percentage of (9) to (2)	Acreage	Percentage of (11) to (2)	Acreage	Percentage of (13) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
S.S.—													
Province Wellesley ...	42,033	nil	nil	4,319	10.3	311	0.7	4,319	10.3	37,714	89.7	7,835	18.6
Malacca ...	108,769	355	0.3	6,736	6.2	673	0.6	7,091	6.5	101,678	93.5	16,737	15.4
Penang ...	2,720	nil	nil	441	16.2	35	1.3	441	16.2	2,279	83.8	60	2.2
Singapore ...	28,824	1,624	5.6	4,485	15.6	426	1.5	6,109	21.2	22,715	78.8	1,982	6.9
Total S.S. ...	182,346	1,979	1.1	15,981	8.7	1,445	0.8	17,960	9.8	164,386	90.2	26,614	14.6
F.M.S.—													
Perak ...	270,904	392	0.1	11,898	4.4	2,367	0.9	12,290	4.5	258,614	95.5	30,737	11.3
Selangor ...	296,686	986	0.3	10,070	3.4	2,216	0.7	11,056	3.7	285,630	96.3	29,641	10.0
Negri Sembilan ...	242,895	1,081	0.5	17,336	7.1	3,028	1.2	18,417	7.6	224,478	92.4	21,184	8.7
Pahang ...	84,734	870	1.0	6,195	7.3	2,049	2.4	7,065	8.3	77,669	91.7	3,167	3.7
Total F.M.S. ...	895,219	3,329	0.4	45,499	5.1	9,660	1.1	48,828	5.5	846,391	94.5	84,729	9.5
U.M.S.—													
Johore ...	464,736	5,495	1.2	31,597	6.8	15,063	3.2	37,092	8.0	427,644	92.0	44,055	9.5
Kedah ...	191,614	4,018	2.1	6,863	3.6	3,798	2.0	10,881	5.7	180,733	94.3	23,129	12.1
Kelantan ...	30,567	403	1.3	4,011	13.1	983	3.2	4,414	14.4	26,153	85.6	2,567	8.4
Trengganu (d) ...	4,817	nil	nil	nil	nil	nil	nil	nil	nil	4,817	100.0	1,738	36.1
Perlis (e) ...	1,337	nil	nil	190	14.2	89	6.7	190	14.2	1,147	85.8	274	20.5
Brunei ...	6,211	nil	nil	1,017	16.4	211	3.4	1,017	16.4	5,194	83.6	758	12.2
Total U.M.S. ...	699,282	9,916	1.4	43,678	6.3	20,144	2.9	53,594	7.7	645,688	92.3	72,521	10.4
Total MALAYA ...	1,776,847	15,224	0.9	105,158	5.9	31,249	1.8	120,382	6.8	1,656,465	93.2	183,864	10.3

Notes.—(*a*) Area out-of-tapping on estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.

(*b*) The acreage shown in column (7) is included in columns (3) and (5).

(*c*) Areas of tappable rubber rested under rotational systems are not considered as out-of-tapping and therefore (11) and (12) include columns (13) and (14) respectively.

(*d*) Registered companies only.

(*e*) Figures for the quarter ending 30th June, 1941.

MALAYAN RUBBER STATISTICS Table I.

ACREAGE, STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JULY, 1941, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption	
								during the month		January to July 1941		during the month		January to July 1941						
	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to July 1941	during the month	Jan. to July 1941	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to July 1941
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	7,084	15,202	17,107	110,426	14,796	61,439	Nil	Nil	Nil	Nil	12,889	15,884	92,890	79,066	...	10,154	15,107	155	,002
Johore ...	...	5,452	6,117	7,853	52,638	5,344	40,851	Nil	100	Nil	263	1,793	11,561	18,061	73,351	...	5,078	6,434	...	...
Kedah ...	...	741	3,812	4,181	27,016	2,227	11,630	Nil	Nil	Nil	Nil	977	5,061	8,239	30,537	...	879	4,044	...	...
Perlis ...	..	42	28	24	147	35	235	Nil	Nil	Nil	Nil	Nil	38	Nil	357	...	55	36	...	...
Kelantan ...	...	528	555	544	3,265	560	4,343	Nil	Nil	Nil	Nil	142	914	1,276	5,924	...	449	682	...	...
Trengganu ...	...	38	160	223	1,142	482	2,821	Nil	Nil	Nil	Nil	Nil	583	20	4,085	...	161	159	...	...
Brunei ...	...	...	46	77	464	78	769	...	...	...	...	...	131	...	1,207	...	19	51	...	...
Total Malay States	...	13,885	25,920	30,009	195,398	23,522	122,088	Nil	100	Nil	263	15,801	34,172	120,486	194,527	...	16,795	26,513	155	1,002
S. SETTLEMENTS :—																				
Malacca ...	...	1,971	1,603	1,571	10,996	861	6,215	Nil	30,489	Nil	190,147	3,665	Nil	21,717	Nil	...	2,146	1,485	...	...
Province Wellesley ...	...	2,329	727	656	4,273	239	1,948	Nil		Nil		13,576		82,065		...	1,622	761	...	...
Penang ...	3,484	4,043	11	28	180	86	843	956		9,606						5,188	3,955	19	...	...
Singapore ...	12,347	23,389	275	225	1,410	55	1,024	25,786		149,629		47,015		254,057		14,205	18,186	301	39	208
Labuan ...	...	37	Nil	Nil	Nil	9	116	71		449		Nil		Nil		...	24	Nil	...	...
Total Straits Settlements ...	15,831	31,769	2,616	2,480	16,859	1,250	10,146	26,813	30,489	159,684	190,147	64,256	Nil	357,839	Nil	19,393	25,933	2,566	39	208
Total Malaya ...	15,831	45,654	28,536	32,489	212,257	24,772	132,234	26,813	30,589	159,684	190,410	80,057	34,172	478,325	194,527	19,393	42,728	29,079	194	1,210

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	P.We'sly M'cca. Labuan & Brunei	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	8,913	17,426	3,745	3,429	3,845	383
WET RUBBER	1,241	760	210	382	1,233	496
TOTAL ...	10,154	18,186	3,955	3,811	5,078	879

TABLE III
FOREIGN EXPORTS

PORTS	For month	Jan. to July 1941
29	30	31
Singapore ...	56,342	329,439
Penang ...	16,047	100,590
Port Swettenham.	7,668	48,074
Malacca ...	Nil	222
TOTAL ...	80,057	478,325

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	Jan. to July 1941
32	33	34
Malay States ...	49,910	314,518
Straits Settlements	3,966	27,210
MALAYA ...	53,876	341,728

Notes:—
1. Stock on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + imports + Stocks at beginning of month = Exports + Stock at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stock elsewhere are in dry weights as reported by the dealers themselves.
4. Columns (33) and (34 represent exports of rubber subject to regulation which for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics. S.S. and F.M.S., at Singapore on 28th August, 1941.

METEOROLOGICAL SUMMARY, MALAYA, JULY, 1941.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of			Absolute Extremes									Number of days.							
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet	Total.		Most in a day. Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Total.	Daily Mean.	Per cent.
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hrs.	hrs.	
Kuala Lumpur Aerodrome, Selangor ...	91.0	72.6	81.8	†	†	†	†	84.9	86.8	8.57	217.7	†	14	12	5	2	—	197.75	6.38	52
Port Swettenham Aerodrome, Selangor ...	89.9	71.9	80.9					87.1	88.0	4.53	115.1		13	10	3	—	—	213.70	6.89	56
Sitiawan, Perak ...	91.3	73.2	82.3					85.5	87.0	4.29	109.0		12	8	3	—	1	221.10	7.13	58
Ipoh Aerodrome, Perak ...	91.9	72.6	82.3					85.4	86.2	3.25	82.6		11	9	2	—	1	222.55	7.18	58
Temerloh, Pahang ...	92.0	72.5	82.3					86.5	88.4	3.77	95.8		12	10	2	6	—	197.15	6.36	52
Kuala Lipis, Pahang ...	90.5	72.4	81.5					85.1	86.5	4.02	102.1		10	8	3	30	—	208.25	6.72	55
Kuala Pahang, Pahang ...	88.5	74.9	81.7					87.9	89.4	2.43	61.7		11	7	2	—	2	218.20	7.04	57
Kallang Aerodrome, S'pore ...	87.8	78.3	83.1					84.2	85.7	13.64	346.5		12	11	4	—	1	203.35	6.56	54
Bayan Lepas Aerodrome Penang ...	88.3	74.2	81.3					85.8	86.6	5.06	128.5		17	13	2	—	—	200.15	6.45	53
Malacca Town, Malacca ...	86.1	74.1	80.1					84.2	86.3	9.83	249.7		15	14	7	—	4	203.35	6.56	54
Kluang, Johore ...	88.9	71.6	80.3					81.9	84.1	8.10	205.7		16	14	5	9	1	173.15	5.59	46
Mersing, Johore ...	89.0	72.6	80.8					84.2	85.1	3.49	88.6		18	15	4	—	2	200.65	6.47	53
Alor Star, Kedah ...	88.6	74.1	81.3					85.5	87.0	5.76	146.3		18	15	3	—	2	203.30	6.56	53
Kota Bahru, Kelantan ...	90.3	74.0	82.1					85.6	86.3	7.30	185.4		16	15	3	1	—	181.40	5.85	47
Kuala Trengganu, Trengganu	89.3	73.6	81.5					85.1	87.2	8.58	217.9		11	8	4	—	3	190.60	6.15	49
Labuan ...	87.4	76.6	82.0					85.4	87.4	8.88	225.6		16	15	1	—	—	206.15	6.65	54
HILL STATIONS.																				
Fraser's Hill, Pahang, 4268 ft.	74.9	64.4	69.1					73.1	73.8	2.66	67.6		15	9	1	7	—	195.45	6.30	51
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	73.2	54.7	63.9					71.9	71.5	5.48	139.2		14	13	1	—	—	188.70	6.09	49
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	72.3	59.9	66.1					*	*	5.55	141.0		12	12	—	1	—	205.80	6.64	53

* Not recorded.

† Restrictions have been placed on the supply of certain types of Meteorological information.